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"Shamrock IV" in Drydock

Her Form Shows That the Challenger Will be Formidable in Fresh to Strong Breezes.

IN spite of her lofty sail-plan, "Shamrock IV," in her trials against the 23-meter "Shamrock," proved to be too stiff for the best results. She was placed in dry-dock and five tons were removed from her lead bulb. It was during this docking that the accompanying photographs were taken; and they are the first views that give a correct impression of the challenging yacht's under-water profile and model.

It takes but a glance at these two views to see that designer Nicholson has aimed at securing the most powerful boat that was possible under the limitation of a 75-foot water-line length. In doing this, he evidently was satisfied that the penalty imposed by the rule on full ends would be more than offset by the premium gained through large displacement (which the rule encourages), and by the great sail-carrying power which goes with the shoal, full-ended, bulb-fin type of hull.

Of the three cup defenders, "Resolute" is farthest removed in model from "Shamrock IV," and a study of the accompanying line-drawing, showing the approximate midship sections and water-line planes of the two yachts, will be of interest.

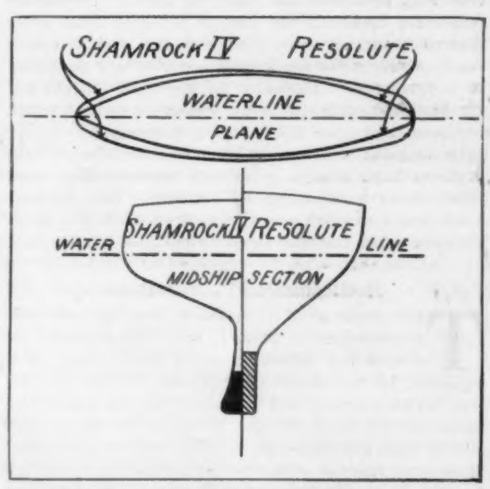
"Resolute" is built closely to the rule. She has very fine ends, conforming to the "quarter-beam" requirement. She has a deep V-section, with an easy bilge and steep floor, insuring a combination of large displacement with a form easy to drive. The rule favors sharp-ended boats of moderate beam; encourages displacement, and penalizes sail area. "Resolute" is a sharp-ended, moderate-beam boat, of large displacement and moderate sail area. Hence, her rating is low, and it is certain that "Shamrock IV" will have to allow her, should she be the chosen defender, a large time allowance, not less, surely, than five or six minutes.

The new rating rule, however, takes no direct account of an element in yacht design, which, in races sailed in September over the Sandy Hook course, is one of the most important of all. We refer to the "wetted surface." In this respect "Resolute" has considerable advantage over both "Vanitie" and "Defiance," and will have an enormous advantage over "Shamrock IV."

In a recent editorial we drew attention to the fact that, in light winds, when the speed of two competing yachts of the 75-foot class is, say, 6 or 7 knots, the skin friction is the most important resistance, and the yacht with the larger ratio of sail area to wetted surface will be the faster, other things being equal.

It is largely this feature in "Resolute" which causes her to pull away from her rivals as the wind lightens and the speed decreases.

Now, if the midship section of "Shamrock IV" is compared with that of "Resolute," it will be seen that a tapeline measurement, touching the hull, around "Shamrock IV" will give her several feet more girth than "Resolute." Similarly, a linear measurement around a horizontal section of the two yachts at the water-line will show that "Shamrock IV" has the greater perimeter. Hence, the wetted surface of "Shamrock IV" must greatly exceed that of "Resolute." This raises the question as to whether the excess of sail carried by the challenger will suffice to overcome this difference, plus the time allowance. In the last series of races for the cup, "Reliance" had more wetted surface than "Shamrock III"; but she had over 16,000 square feet of sail as against "Shamrock's" 14,000, and in light winds she easily drew away from her.



Approximate midship sections and water-line planes of "Shamrock IV" and "Resolute."

The broad, shoal body of "Shamrock IV," giving a high center of buoyancy, and her heavily bulbed lead, giving a low center of gravity, account for her great sail-carrying capacity, and in strong winds sufficient to put her down to her lee rail, she should be a very fast boat. Moreover, her unusually long fin keel (30 feet on the bottom, or 50 per cent more than the keel of "Resolute"), although it still further increases her wetted surface, should make her point high into the wind when close-hauled. She should be the fastest boat of the four in winds of from 12 to 25 knots, particularly when the wind is offshore and the sea is smooth. Under these conditions she should also be fast in reaching.

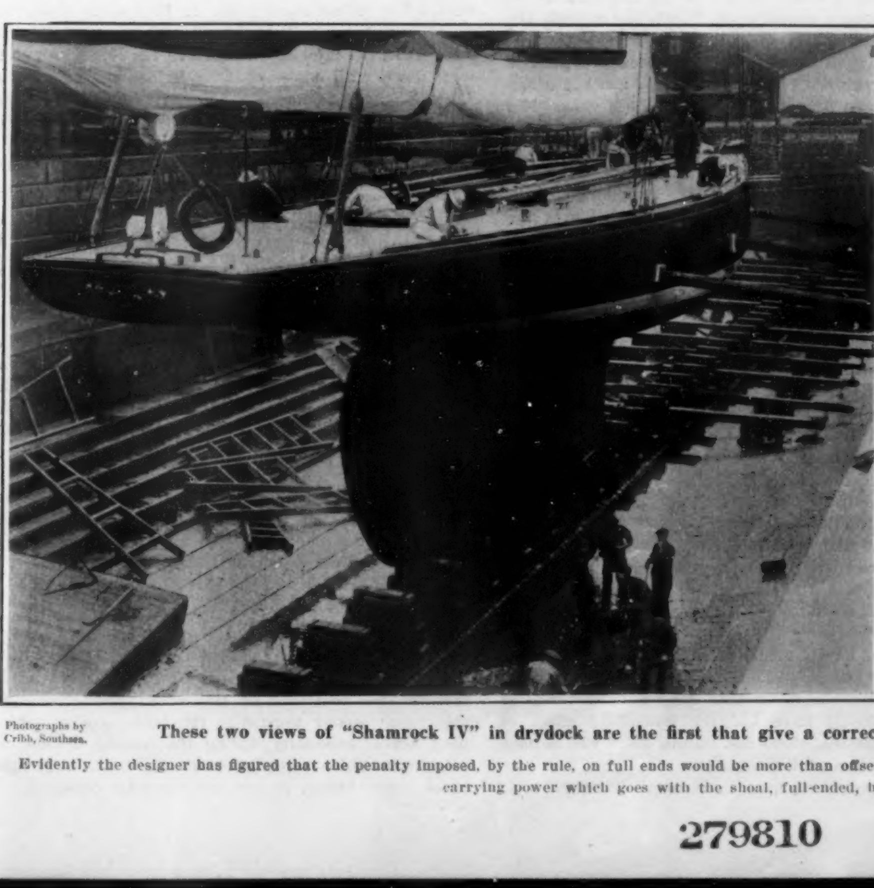
But how often do such winds prevail in September on the Sandy Hook course? They are extremely rare. The writer, during one of the "Shamrock" series of races, went out eleven times to Sandy Hook, without seeing two races completed within the time limit, so light were the winds.

"Shamrock IV" has more than once beaten the 23-meter "Shamrock" a minute a mile in fresh breezes; but as the wind lightens, the older boat seems, so far, to hang on to her rather closely. The removal of lead, enabling the boat to heel down to her best sailing lines, appears to have made her more lively in light winds, and she will improve as the tuning-up progresses.

In any case, there is promise of a very interesting contest next September.

A Water Model of the Electric Arc

ONE of the essential properties of the electric arc is that, when the current through the arc increases, the potential difference between its terminals decreases. At the recent Conversazione of the Royal Society, Mr. W. Duddell exhibited a water model of the electric arc which consists of a mushroom valve. The pressure tending to reseat the valve is so arranged that it diminishes very rapidly as the valve lifts. In this way, when the flow of water is increased through the valve, the difference of pressure between its two sides decreases and thus represents one of the properties of the electric arc. When a steady flow is established and a column of water having a definite periodic time is connected to the valve, oscillations can be set up similar to those obtained with an electric arc.



Photographs by Cribb, Southsea.

These two views of "Shamrock IV" in drydock are the first that give a correct impression of her under-water profile and model.

Evidently the designer has figured that the penalty imposed, by the rule, on full ends would be more than offset by the premium gained through large displacement, and by the great sail-carrying power which goes with the shoal, full-ended, bulb-fin type of hull.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Mr. Brewer Criticises Langley

IN a letter which recently appeared in the New York *Times*, Mr. Griffith Brewer, well known in British aeronautical circles, ungenerously criticises the work performed by the late Samuel Pierrepont Langley, and thus tends to throw additional discredit upon a man who in his lifetime suffered much abuse, but who, as a pioneer in aerodynamic experiment, laid for his successors a secure foundation of principle on which they might safely build.

Most great inventions are not absolutely original productions. They are what, in the parlance of the patent lawyer, are called "new combinations of old elements, producing new results." Because they do produce new results they may be of epoch-making importance, and entitled to the protection of the patent laws. Every one of the great technical achievements of the past, thus considered, is curiously old and yet strikingly new, the brilliant and enduring work of the Wright brothers not excepted.

When it comes to sheer inventiveness, Langley outdistanced every experimenter in aviation with the one exception of Hiram Maxim. From Newton to Newcomb mathematicians had proven, apparently with all the conclusiveness that mathematics gives, the utter absurdity of attempting to fly mechanically. A surface increases as the square; a weight increases as the volume or cube; obviously a very small increase in weight or volume meant a hopelessly large increase in carrying surface. That reasoning was successfully used to shatter the hopes of those who believed in the possibility of mimicking the soaring bird.

Into this field, occupied by monomaniacs, who were classed with circle squarers, perpetual motion imbeciles, and similar scientific madcaps, Langley ventured, determined to bring scientific reasoning and experiment to bear where there had been only wild raving. His first work was to establish beyond a doubt that the mathematicians were wrong in maintaining that a prohibitively large surface would be required to carry a small weight. To upset the scientific axioms of centuries by brilliantly novel experiments was in itself an achievement. But he did much more. Not only did he demonstrate conclusively exactly what were the character and magnitude of the forces acting upon plane surfaces in motion, but he eventually succeeded in building the first successful motor-driven model of a flying machine in the history of the world. Never before had there been such a contrivance; never, with the single exception of Penaud's rubber-motor models, had a mechanical contrivance sustained itself in the air for so much as a minute. And yet Mr. Brewer fails to understand why so much attention is given by the newspapers to this man!

It is quite beside the mark to compare the general efficiency of the Wright machine with that of the Langley "Aerodrome." The sole purpose of the Hammondsport test is to continue an experiment begun by Langley, but unfortunately terminated because of adverse newspaper criticism. In justice to Langley's memory, it is fitting that the machine should be thoroughly tried. Mr. Curtiss has nothing to gain by the experiment. Wing warping is not involved. The success of the Langley machine, decided enough from the standpoint of the patent lawyer, will not help Mr. Curtiss in the least. His is an act of piety, which deserves commendation.

No one realized more keenly than Langley himself the limitations of his aerodrome. We open the "Langley Memoir of Mechanical Flight" published by the Smithsonian Institution and we read this: "It was thought that a control mechanism which should be more sensitive and at the same time should act more powerfully [than the Penaud tail] to prevent the upsetting of the equilibrium when the machine was subjected to rather strong disturbing forces, was desirable for any machine which was to transport a human being, and therefore involved the risk of a fatal accident." Over and over again it is expressly stated that Langley regarded this machine only as an experiment. It was a step from an unmanned to a manned machine. Had the great secretary of the Smithsonian Institution been spared to continue his work, he would unquestionably have employed other controlling mechanism than the dihedral angle and the automatic tail, although machines on the Langley principle, notably the "Fokker," have flown successfully in Europe over and over again.

The problem of control constantly haunted Langley. Better than any of his predecessors, he realized how all-important it was. There was hardly a form of control which he did not at least sketch out on paper. "The more frequently recurring of these," says the Langley memoir, "were devices for *changing the angle of the wings or tail*, and others for shifting the wings or tails bodily, so as to shift the position of the center of pressure with respect to the center of gravity, the motive power for operating the devices being in some cases derived from a gyroscope or pendulum, and in others small electric motor apparatus controlled by a pendulum or a gyroscope." Evidently Langley had thought out for himself practically every system of control which has been tried since flying became a reality.

In singular contrast to Mr. Brewer, the Wright brothers have always generously acknowledged their indebtedness to Langley and Chanute. They at least knew how necessary was the work of these two great pioneers before the marvelous Wright flier could soar.

Battleships as Peacemakers

THE decision of Congress to sell the two predreadnoughts "Idaho" and "Mississippi" to Greece was influenced to no little extent, it is rumored, by the desire of President Wilson to avert war between Greece and Turkey. That the sudden increase in the naval strength of Greece by the acquisition of these two ships has served to prevent a seriously threatened renewal of the Balkan hostilities, is believed by those who are familiar with the naval and diplomatic conditions so far as they affect Turkey and Greece. Certainly the naval situation, as recited below, justifies this conclusion.

During the Balkan war the Greek navy showed a decided superiority over that of Turkey; but the situation was completely reversed, at least as far as regards *materiel*, when Turkey recently purchased the powerful dreadnought which is nearing completion at the yard of the Vickers firm in England. This ship, the "Rio de Janeiro," which was illustrated in the SCIENTIFIC AMERICAN of May 31st, 1913, is one of the largest and most powerful dreadnoughts yet constructed. With a length of 660 feet, a displacement of 27,500 tons, and a speed of 22 knots, she mounts the largest 12-inch battery in the world, carrying, as she does, no less than fourteen 12-inch, 50-caliber guns in seven 2-gun turrets. In addition to this she has a secondary battery of twenty 6-inch, 50-caliber guns. Her main battery, be it observed, is more powerful by two guns than that of our "Arkansas" and "Wyoming."

Now the purchase by Turkey of this powerful ship had completely altered the relative standing of the two navies; for with her overwhelming gun-power and good speed of 22 knots, she would have been capable of handling unaided the whole Greek fighting line. Hence it can be understood that, in the recent trouble with regard to certain islands that have been ceded to Greece, Turkey felt herself to be in a position to enter into a controversy, which, should diplomacy fail, would be settled in her favor upon the high seas.

Greece, in her dilemma, looked around for some ready means of turning the tables upon Turkey and backing up her diplomacy by a show of superior naval strength. It so happened that the "Rio de Janeiro" was not quite completed and would not be available for use by Turkey for some little time; and when, as the result of her search in the battleship market of the world, Greece found that two thoroughly equipped and well-seasoned battleships of the United States Navy were available for sale, the negotiations were opened which have resulted in the purchase of the "Idaho" and the "Mississippi."

To those of us who understand the intimate relations between battleship strength and a nation's foreign policy, it is not surprising that this sudden reversal of conditions should have had the immediate effect of dissipating the war cloud and leading these two nations to arrange a peaceful compromise.

And so, once more, we see a concrete illustration of the truth that a preponderance of naval strength sufficient to secure the command of the sea, serves not as a provocative to war, but as a means, and a most effective means, of preserving the peace. Greece, exhausted by the recent struggle, had no desire to renew it; Turkey, eager to recover some of the prestige she has lately lost, and believing herself to possess a preponderance of sea-power, would, no doubt have welcomed the conflict.

Battleships are cheaper than battles; and, as we have shown in our recent series of articles on the problem of our own Navy, there is no surer way to preserve the peace than to maintain an adequate naval force, sufficient to discourage any foreign country from attempting to interfere with national policies by a demonstration of naval force.

As regards the relative advantages of this bargain, they are fairly well balanced between the two countries. For Greece, the acquisition of the "Idaho" and "Mississippi" means not only a great increase of strength, but the prevention of a war which would have cost far more than the price paid for the ships. As regards the United States it means the substitution for two predreadnought ships of a modern dreadnought of the largest size and of maximum offensive and defensive power. How great is our gain is shown by the following consideration:

For the sum derived from the sale of the "Idaho" and the "Mississippi," whose aggregate displacement is 26,000 tons, we can build a 32,000-ton "Pennsylvania," which is a clear gain of 6,000 tons of displacement.

For the eight 12-inch guns of the two vessels, we secure twelve 14-inch guns—a clear gain of four 14-inch pieces.

The total muzzle energy of the eight 12-inch guns is 350,000 foot-tons. The total muzzle energy of the twelve 14-inch guns is 780,000 foot-tons—a clear gain of 420,000 foot-tons, which is an increase in hitting power of considerably over 100 per cent.

In place of the 9-inch armor on the "Idaho" and "Mississippi," covering the waterline, we have the 13½-inch armor on the "Pennsylvania"—a gain of 4½ inches in thickness, and a gain, furthermore, in the quality of the armor, due to later methods of treatment.

For the speed of 17 knots of the "Idaho" and "Mississippi" we have a speed of 21 knots in the "Pennsylvania"—a clear gain of 4 knots.

Finally, and most important of all, is the fact that in place of two of the smaller ships of our second line of battle we are able to put into our first line of battle one of the most powerful and up-to-date ships of the dreadnought class.

Some Great Marine Disasters

A RECORD of the most serious marine disasters since 1850 shows that the list is headed by the sinking of the "Titanic," when 1,595 people were lost. This is followed by the recent loss of the "Empress of Ireland," the total of whose fatalities is now placed at over 1,024. It is estimated that 1,000 lives were lost in the burning of the "General Slocum" in the East River, New York, in 1904. In September, 1912, the "Kickermaru" was wrecked off the coast of Japan, with a loss estimated at 1,000. In September, 1905, the Japanese warship "Mikasa" sank with a loss of 599. In June, 1894, the "Norge," wrecked in the North Atlantic, went down with a loss of 600. In September, 1890, a Turkish frigate foundered off Japan with a loss of 540. In August, 1876, the "Great Queensland," loaded with powder, is supposed to have been blown up in mid-ocean, for she was never heard of again, and 589 perished. In April, 1873, the "Atlantic" of the White Star Line was wrecked off Halifax with a loss of 547.

The Rigidity of the Earth

THAT the earth is not an absolutely unyielding solid has long been known, and there are several methods for evaluating the elasticity of the whole earth. The results are a little surprising. The ocean tides have an amplitude less than that they would have if the earth were absolutely rigid, and from this difference the rigidity of the earth may be calculated. On this method it appears that the earth is about as rigid as if it were composed wholly of steel.

A second method is based on observations made on the displacements of the poles. If the earth were absolutely rigid this movement would have a period of 305 days. The actual period is longer, and the difference enables the elasticity of the earth to be calculated.

Rabbits on Laysan Island, the well-known Hawaiian bird reservation, have multiplied to such an extent since they were introduced a few years ago as to threaten the existence of the island vegetation. As this result would jeopardize the bird colonies, which need shade, especially during the nesting season, an expedition which recently visited the island destroyed about 5,000 rabbits, or one half the total colony.

Engineering

Drainage Ditches by Blasting.—A recent issue from the Du Pont magazine contains an account of the blasting of a drainage ditch 2,600 feet in length which contains 1,732 cubic yards. The work was done with 1,400 pounds of 60 per cent nitro-glycerine dynamite. The total cost was $383, or 22.1 cents per cubic yard.

Yachts in the Panama Canal.—Under one of the new rules, recently promulgated by Col. Goethals, a vessel may enter Gatun Lake from either end of the canal, and, without passing through the locks at the other end, may return to the original point of entry of the canal, without payment of additional toll.

Economy of Electric Welding.—Before the Ohio Society of Mechanical, Electrical and Steam Engineers, it was recently stated that in a locomotive shop using electrical welding apparatus the cost of repairing forty cracks in side sheets of fire boxes by electric welding was $6.65. To renew the damaged sheets would have cost about $1,350.

Vitality of Wooden Bridges.—Bridges built of timber, and particularly those of the Howe truss type, have shown a remarkable longevity, especially where they are covered in from the weather. A case in point is a bridge over Little River, near Springfield, Mass., which was recently torn down. It was built in 1835 and was only recently removed for reconstruction because of decay in some of the woodwork.

The World's Largest Ship.—The third of the famous trio of large ships which the Hamburg-American Line will have in service next year was recently launched at Hamburg. She was christened the "Bismarck" by the German Emperor before a notable gathering. The new liner is 955 feet in length, 100 feet in beam, and of 60,000 tons displacement. Like the "Vaterland," she will be driven by turbines operating on four shafts. She is designed to maintain an average speed of about 23.5 knots.

The Opening of the Berlin-Stettin Canal.—The opening of the Berlin-Stettin Canal in the presence of the Kaiser marked the inauguration of the active service of a new waterway, which, it is expected, will ultimately raise Germany's most important seaport in the Baltic to a position of importance rivaling that of the North Sea harbors of Hamburg and Bremen. The canal cost $12,500,000, and it is estimated that every year about three million tons of freight will be shipped through the new waterway.

Air Propeller Boat for Demerara.—The *Engineer* of London describes a boat propelled by an air propeller which has been constructed for use in Demerara. The vessel is 30 feet in length and 10 feet in beam, and is of the barge type. It is driven by a 15-horse-power oil engine, chain connected to a 9-foot air propeller, which runs at 1,200 revolutions per minute. With a thrust of 200 pounds it is stated that the tow barge has made an average speed of 5 miles per hour. The design is certainly more curious than economical.

Old Battleship as Target.—The results obtained from the old battleship "Texas," when she was used in 1910 as a target, have been so valuable as a guide to the design of battleships, that the request of naval officers that our obsolete battleships, such as the "Iowa" and "Indiana," be used for such target practice, should receive every encouragement. England, France and Germany have been making a free use of obsolete ships for this purpose, and the information thus acquired is of far more value than the cash sum which could be realized in selling these vessels to be broken up.

A Concrete Buoy.—Reinforced concrete, during the past few years, has been invading many fields which hitherto have been considered as belonging exclusively to iron and steel. One of the interesting illustrations of this fact is the construction of a concrete buoy at Kingston, Jamaica. It is stated that the cost is only about fifty per cent of the cost of a similar buoy made of steel. To prevent the mooring chain from injuring the bottom of the buoy, the latter is made concave. The manhole cover was grouted into its place after the buoy was afloat. Leakage is handled by means of a small pump-hole provided for that purpose.

Water in Exchange for Refuse.—Milwaukee has a refuse incinerator with a total capacity of 300 tons a day. A 600-kilowatt-hour turbo-generator is driven by the steam raised in a 200-horse-power boiler. The current from the generator is to be transmitted to a flushing-tunnel pumping station, some two miles distant, for pumping lake water into the north end of the Milwaukee River for flushing and cleaning purposes.

Locomotive Gases as Conductors.—It is well known that discharges may occur from high pressure trolley wires to steam locomotives through the exhaust stack. They may take place through shorter distances than when there are no steam and gases escaping from the stacks. A comparison when a locomotive was exhausting between trolley wire and track and when no locomotive was present, proved that it required on an average about one half the voltage to break down the air when the locomotive was present.

Science

The Journal of Egyptian Archæology.—A new quarterly journal with this title has been inaugurated by the Egyptian Exploration Fund, in London. It will deal with all branches of Egyptological research.

Population of the Balkan States.—The following are the latest estimates of population in the reconstructed Balkan States, according to the *Geographical Journal*: Turkey in Europe, 1,590,000; Bulgaria, 4,467,006; Rumania, 7,514,976; Servia, 4,547,990; Greece, 4,363,000; Montenegro, 516,000; Albania, 1,000,000.

Memorial Chair to John Henry Poynting.—Through the generosity of Sir George Kenrick, the Chair of Physics at Birmingham University has been endowed with securities to the value of $90,000, in memory of the late John Henry Poynting. The Mason Chair of Physics will accordingly henceforth be known as the Poynting Chair of Physics.

Sir Douglas Mawson.—The honor of knighthood has been conferred upon Dr. Douglas Mawson, leader of the recent Australasian Antarctic Expedition to Wilkes Land. Mawson was also a member of Shackleton's Antarctic expedition, and has made geological explorations in the New Hebrides. He was born in England but educated in Australia, where he has spent most of his life.

A New Town in Central Asia.—The Russian Ministry of Agriculture is planning to construct a new town, to be called Amu-Darjinsk, in the Hunger Steppe of Central Asia, which has now been made available for agriculture by the irrigation system of the Romanov Canal. Parcels of land are to be leased, and will ultimately become the property of the tenants. More than 4,000 applications for land have already been received.

A Fur-Seal Commission, consisting of Mr. Edward A. Preble, assistant biologist of the U. S. Biological Survey; Mr. W. H. Osgood, of the Field Museum of Natural History, Chicago, and Dr. G. H. Parker, of Harvard University, has been sent by the Government to the Pribilof Islands this summer to ascertain the condition of the seal herd, and to study various economic and scientific questions connected with its administration.

The Transcontinental Geographical Excursion in 1912.—An echo of this memorable enterprise, which was conducted by the American Geographical Society for the purpose of giving foreign geographers an intimate view of the United States, is the announcement just made by the society that a memorial volume will be published this summer, containing 26 papers written by participants in the excursion. The papers will be technical in character, and written in several languages.

Radioactivity at the Panama Exposition.—A committee has been formed in Germany to arrange an exhibit at the Panama-Pacific Exposition, 1915, which will cover the whole field of radioactivity and illustrate in a striking manner the vast development of the subject since the historic discovery made by the Curies in 1898. The exhibit will trace the history of discoveries in radioactivity and allied branches of science; show methods of producing radioactive substances; and illustrate all known phenomena and applications of radioactivity in physics, chemistry, medicine, and various industries. Numerous technical and popular lectures, accompanied by experiments, will be given in connection with the exhibit.

International Upper-Air Research in the Arctic.—The Rome (1913) meeting of the International Meteorological Committee appointed a special commission, with Gen. Rykachev, of St. Petersburg, as president, to arrange an international campaign of upper-air observations around the north polar basin in conjunction with similar observations to be made by the forthcoming Arctic expeditions, especially Amundsen's proposed north polar drift. The commission held a meeting at Copenhagen, February 28th to March 1st of the present year. It was announced that the Canadian government had decided to equip at least two and perhaps four Arctic stations with balloons and theodolites, and that upper-air observations would be made by one or both sections of the Canadian Arctic expedition now in the field. Two Canadian stations, one at York Factory and one at the northern point of Labrador, are to be equipped with wireless telegraphy. The Russian meteorological service hopes to establish stations at a point in Nova Zembla, at Yakutsk, and at Verkhoyansk, equipped with kites, pilot-balloons, and sounding-balloons; while pilot-balloon stations will be operated at Alexandrovsk, Archangel, Vaigach Island, and Obdorsk. The Danish government will have stations in operation at Disco Island, West Greenland, and in Iceland. The German observatory in Spitzbergen will co-operate, and several other stations are proposed. It was decided that, as far as possible, daily observations should be made at the stations, especially during the period from September, 1915, to September, 1916, when it was expected that Amundsen would be nearest the pole. Since the meeting of the commission, Amundsen has announced the postponement of his expedition for another year, and the arrangements described above will doubtless be modified accordingly.

Astronomy

The Problem of Minor Planets.—In a paper before the Académie des Sciences, Louis Fabry indicates two approximate solutions for the calculation of the orbits of the minor planets; one consists in neglecting the perturbations of the elliptic movement and to take four observations neither too close nor too far apart, taken for example in two successive oppositions; the other consists in calculating the orbit by means of four observations taken in four different oppositions, but taking account of the perturbations due to Jupiter. The formulæ established by these methods give a sufficiently approximate solution of the problem of the minor planets.

The Unknown Gases of the Nebula in Orion.—By studying the light emitted by a luminous gas, it is possible, by purely optical methods, to determine the temperature of the gas and also its atomic weight. Observations on the nebula in Orion have been pursued since 1911. By studying the lines in the spectrum of the nebula which are due to hydrogen, it appears that the temperature of the hydrogen in the nebula is about 15,000 degrees. The double ultra-violet line, which is attributed to the hypothetical gas called "nebulium," gives as the atomic weight of this unknown gas the figure 3. A strong green ray, which is also due to an unknown gas, gives the figure 2 for its atomic weight.

The Nebula in Andromeda.—It is now an established fact that the majority of the nebulæ known to us are spiral nebulæ. Their study is very important, and in particular a knowledge of their spectra is capable of furnishing us with valuable information. The study of the spectra of nebulæ is rendered very difficult by the small intrinsic brightness they possess. Nevertheless, some careful experiments made by Slipher on the nebula in Andromeda render it probable that the nebula has a radial velocity of about 300 kilometers per second, a result which is distinctly greater than the figures formerly obtained for other nebulæ. If the nebula in Andromeda approaches the solar system with this velocity, it suggests that the new star which appeared near its nucleus in 1885 had been a dark star which was encountered.

Displacements of Groups in Space.—During the last year researches have been made in the observatory at Potsdam on the radial velocities of the principal stars in the group Praesepe and the results obtained are very interesting. The group appears to be characterized by a large positive radial velocity, the average velocity being about 36 kilometers per second. But the movements of this group seem strongly analogous to the movements of the group Hyades. Schwarzschild and Hertzsprung have accordingly investigated the hypothesis which supposes that the two groups are animated by movements identical in magnitude and direction, and it would seem that this hypothesis is confirmed by the results. But the data so far obtained are not sufficient to enable one to decide whether this analogy of movement implies a physical correspondence in the spectra of the stars forming the two groups.

Proper Movement of Feeble Stars.—It is usually considered that the proper movements of the feebler stars cannot, in the majority of cases, be determined; a conclusion based on the assumption that, on the average, the distances of the feebler stars are greatly superior to those of the brilliant stars. Hence the latest results of Comstock, the conclusions from which appear to invalidate this conclusion, are of the highest interest. Comstock has examined 515 stars of magnitudes varying from 7 to 13, and he has found that of this number there are 390, i. e., about 75 per cent, which possess an appreciable proper motion. Considerations drawn from the distribution of the bright stars are confirmed on examining the distribution of the feebler stars. Since the linear value of the stellar movements seems independent of the magnitude, Comstock deduces that, feeble or brilliant, the stars constitute parts of the same stellar system, and that the feeble stars are in reality less distant than would appear from photometric considerations.

Relations Between the Color, Spectra and Parallax of Stars.—Nashan, in the *Astronomische Nachrichten*, has published a very interesting investigation on the above subject. In seeking the relation between color and parallax he has considered 101 stars for which the color is known and the parallax determined. With respect to color the stars have been classed in three categories: (1) white stars, (2) yellow stars, and (3) red stars. Then three groups have been formed of stars of which the parallax is comprised between the limits 0.00 sec. to 0.05 sec.; 0.05 sec. to 0.10 sec.; 0.10 sec. to 0.20 sec.; and, for each class of colors, the percentage of stars belonging to each parallax group has been determined. It is found that the proportion of white stars diminishes as the parallax augments, and inversely, in the case of the red stars. With respect to the spectra, 246 stars were examined and the distribution of parallaxes among the various types of spectra determined. The spectral classes *A* and *B*, to which the white stars belong, were found to contain only feeble parallaxes, the spectral classes to which the red stars belong containing stronger parallaxes, so that the two methods give concordant results.

Prof. E. Bumm of Berlin.

A strong supporter of the use of radium and X-rays in treating myoma and allied diseases.

Friedrich Dessauer of Frankfort.

Who has done pioneer work in establishing the physical principles of radiotherapy.

Prof. B. Krönig of Freiburg.

Who is very optimistic regarding the future possibilities of the X-ray treatment of tumors.

Prof. de la Camp of Freiburg.

Who has been conducting experiments on the use of X-rays in the treatment of tuberculosis.

X-Rays in the Treatment of Disease

The Rationale of Their Application

> *The problems which have to be solved in extending the usefulness of radiation methods for the treatment of disease are only in part biological. The very foundation of radio-therapy rests upon physical science. The debt of medicine to Röntgen is not likely to be forgotten. But other physicists, who have done much faithful work in developing the modern technique of radiotherapy, have not always received that appreciation which they so justly deserve. Among them particular credit is due to Friedrich Dessauer, director of a large electrotechnic establishment at Frankfurt on the Main. The story of Friedrich Dessauer's life work in this field is of peculiar human interest. It was at the time when Röntgen's discovery had just aroused public attention, that Dessauer, then a student in Munich, was asked by the physicians attending on his sick brother, to make an X-ray diagnosis of his ailment. The verdict, which was only too conclusive, was later confirmed by the fatal issue of the disease, sarcoma. These events made a profound impression upon Friedrich Dessauer, who resolved to devote himself henceforth to the furtherance of medical applications of X-rays.*
>
> *At that time this was a much more difficult task than to-day. The technique of the construction of X-ray apparatus with all their appurtenances was as yet undeveloped. Moreover, no institute existed then, in the whole of Germany, offering facilities for the physicist to conduct research in the application of his science to medicine.*
>
> *Another man might have thought this an unsurmountable obstacle. Not so Dessauer. If no such institute existed, he must found one. He, therefore, established a small factory for the manufacture of electrical apparatus, and from the proceeds he financed his experiments in his chosen field. From this nucleus has grown the large establishment of which Dessauer is to-day the director.*

THE curative power of radium and X-rays has formed the subject of many a more or less sensational notice in the daily and popular press. But the public knows very little as to the details of the actual methods employed and the principles upon which they are based.

Among the men who have worked out the scientific principle of the X-ray treatment of tumors and other affections, perhaps none has made more valuable contributions than Friedrich Dessauer, director of a large works at Mannheim, where X-ray tubes and all their appurtenances, as well as many other refined electrical apparatus, are made. It required the labors of a physicist, working hand in hand with many medical men, among them some of the foremost of the profession in Germany, to establish the principles—mainly physical—on which the rationale of the most effective treatment should be based. Friedrich Dessauer is the man to whom the systematic development of this field is chiefly due. We shall here briefly indicate the essence of the principles laid down by Dessauer.

Difference in Sensibility of Tissues.

A basic fact, without which radiotherapy would be impossible, is that different tissues react differently toward the same radiation. Moreover, this variation in sensibility is not haphazard, but follows a simple law: If the different tissues are tabulated in order of their "juvenility," it is found that those at the "juvenile" end are most susceptible, those at the "adult" end least susceptible to X-rays. The words "juvenile" and "adult" as here applied to types of tissue require explanation. Certain cells have marked power of proliferation, and undergo rapid cell division. Immature, growing tissue is of this type, as is also, unfortunately, the tissue of morbid growths, tumors, cancers, etc. These are what have been termed above "juvenile" cells; in technical language they are spoken of as cytotypic. On the other hand, the cells of a fully formed organ often remain unchanged for years. These, the organotypic cells, are there referred to above as the "adult" type.

The importance of this in the treatment of morbid growths needs no emphasis. Were it not for this difference in reaction, it would be difficult or impossible to treat diseased tissues without at the same time subjecting the sound tissues to the same destructive influence.

The Several Components of X-rays, and Their Different Action upon Tissues.

It is well known that X-rays differ in their power of penetrating different materials. This is commonly expressed by saying that they differ in "hardness." Now, X-rays of different hardness exhibit marked differences in their action upon tissues. In particular, it is found that the harder the radiation, the greater is the contrast in its action upon the several types of tissues. For this and other reasons which will appear later, it is highly desirable to use as hard rays as possible. In this connection Dessauer's most recent achievement is of special interest. It has been known for some time that the gamma rays of radium are of the nature of X-rays, but much more penetrating—at least twenty times as hard as the hardest X-rays known until recently. By means of a special tube with water-cooled cathode, Dessauer has quite recently succeeded in producing rays of hardness 1.2 expressed in units, in which gamma rays have hardness 1. As compared with the use of radium, an X-ray tube of this character presents the great advantage that it is capable of giving over one hundred times as much radiation as an ordinary radium preparation of 100-150 milligrammes. On the other hand, for internal application, radium offers obvious advantages, since it can, in many cases, be introduced directly into the part to be treated.

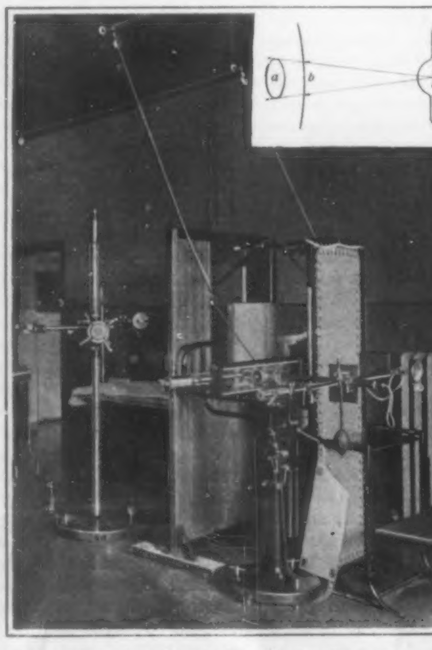
Homogeneity of Field of Radiation.

If the rays are to produce their specific effect on tissues of varying susceptibility, it is, of course, essential that the rays themselves, the field of radiation, be uniform. Thus, if a deep tumor is exposed to the comparatively weak radiation which has traversed several surface layers, while these surface layers themselves receive the full rays, obviously there may be intense and damaging effects produced at the surface, and only slight effects (which act as a harmful stimulant to growth, instead of destroying the tissues) at the greater depths.

A lack of homogeneity in the doses of radiation given to surface and to deep structures may arise from two causes: First, owing to the absorption of radiation by surface layers. Secondly, owing to the fact that the intensity of radiation decreases rapidly with the distance from the source of the rays—the X-ray tube.

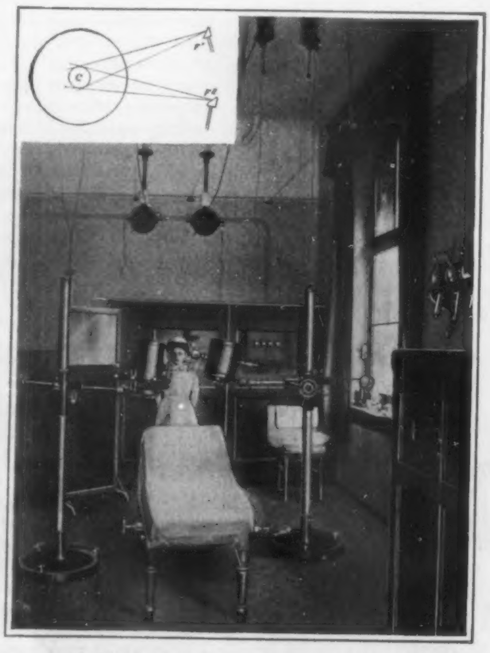
Now, each of these two contributing causes may be, in a measure, met by suitable measures. The remedy for the first cause of inhomogeneity is to use the hardest rays obtainable, so that a minimum amount of absorption takes place in the surface layers. Filters may also be interposed between the tube and the body, to cut the softer

(*Concluded on page 17.*)



Complete hospital outfit for Roentgen Radiation.

The insert illustrates how, by placing anticathode F sufficiently far away, comparatively homogeneous radiation is produced in structures a lying well below the surface b.



Installation for simultaneous cross-fire from two X-ray tubes.

The insert illustrates the method of "cross-firing." F_1, F_2, anticathodes of two Roentgen tubes; C, region at which concentrated field is produced by crossed rays.

The Rodman Wanamaker Transatlantic Flier

Its Successful Trials on Lake Keuka

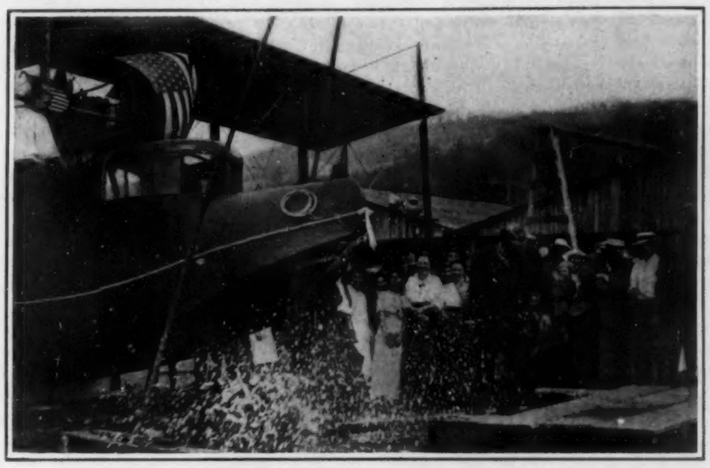
By Our Staff Correspondent at Hammondsport

THE Rodman Wanamaker transatlantic flier, described in the SCIENTIFIC AMERICAN of June 27th, was christened the "America" by Miss Katherine Masson at Hammondsport, N. Y., on June 22nd, and tested the next day by Mr. Curtiss in her first flight, and later by Lieut. Porte, who is to pilot her across the ocean in July. Mr. Curtiss started the huge craft—of 72 feet spread, and weighing, with lightest load, something under 3,500 pounds—for a cautious run along the surface of Lake Keuka at 3:05 P. M., and played her about the lake for a quarter of an hour, to acquire familiarity with the controls. He plied the rudder, the elevator, the ailerons, turned curves in the water, throttled one of the engines to see the effect of an unbalanced thrust, and finally pointed her nose upward and rose on even wing with only part of her full power turned on. The vast throng of witnesses applauded with handclapping and tooting of automobile horns, but rather because it was the famous over-ocean flier than because of any unusual appearance—the sight was all so natural and clock-like in its occurrence.

Mr. Curtiss, after three flights, one with Mr. George Hallett, who will be Lieut. Porte's assistant on the Atlantic flight, and one with Porte himself, came ashore. Then Lieut. Porte took the wheel, with Hallett in the seat, and a large machinist, Mr. Lamonte, in the engine section. The vessel flew very evenly, but with a slight tendency to nose up. This would be corrected later, to some extent, perhaps, by interchanging the engines, so that the blades of the twin propellers should rotate toward the hull while ascending, and thus lift somewhat on the tail plane by a slightly upward blast.

Lieut. Porte returned to shore beaming with satisfaction. He said it was the best machine he ever rode in. He had said, after the 30-hour test of the twin Curtiss motors, that these engines are the best in the world. He now thought, and Curtiss thought, that the Rodman Wanamaker flier must surely be equal to the work of carrying two men, without renewal of supplies, from St. Johns, Newfoundland, to the Azores, a direct distance of about 1,200 miles. The rest of the journey to England *via* the coast of Spain hardly gives them a thought.

Of especial interest was the test of the airboat's steadiness of course when the twin propellers gave unequal thrusts in flight. It had been said that if one motor should stop, the craft would spin around sidewise; but Mr. Curtiss's consulting engineers had calculated the amount of turn of the vertical rudder that would keep her flying straight ahead with only one propeller pushing, and had found the rudder angle not excessive for a moderately prolonged voyage—rather under 15 degrees. The first trials seemed to bear out this estimate.



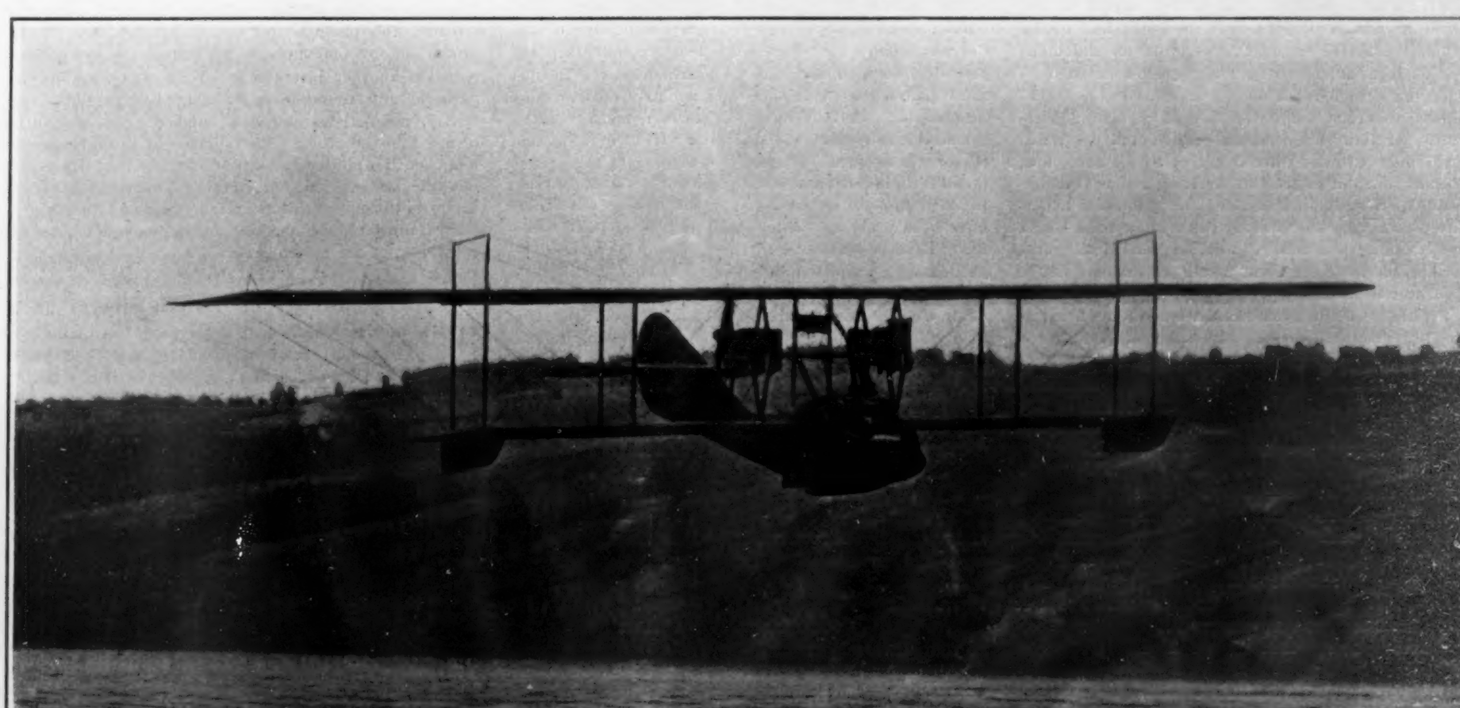
Christening the "America."

The "America" taking the water.

This test was only preliminary; for the total weight carried was three quarters of a ton short of the 5,000 pounds to be lifted at St. Johns, and the engines, as shown by their separate tachometers, were running hardly above 800 revolutions per minute, instead of the 1,300 possible revolutions. Still, the craft planed at 40 miles an hour over the water, and at 50 miles an hour in the air, as estimated by Mr. Curtiss, without instruments. She did not leak nor ship water. She planed well, rose promptly, was stable in the air and on the water, turned easily to right and left, and volplaned easily to the lake when the engines were shut off. No sharp or complete turns were made in these earliest flights on the narrow lake; but the turning will come easily.

Some changes and adjustments were found advisable. The aviators, sitting side by side in the windowed cabin, obstructed each other's view. Curtiss at once cut additional portholes on the side, to be covered with transparent celluloid, like the others. Side planes, jutting out from the hull to catch the water and help to lift the 2½ tons into the air, were to be added promptly.

Further experiments were to be made, extending through the week. Over 1,500 pounds of gasoline and oil were to be added. Two kinds of propeller were to be compared, and the most effective chosen. Every possible weakness was to be searched for in severe trials, and corrections made accordingly. Then the resplendent red queen of the ocean was to be sent to Newfoundland to make acquaintance of the Atlantic, and prepare for the momentous voyage. As these lines



The first flight of the "America" over Lake Keuka, Hammondsport, N. Y.

are written a fierce thunderstorm, tearing the boughs from the low-bending trees, has just passed over the aerodrome, drenching the dozen men who helped to restrain the airboat tugging at her moorings beside the lake, moorings made of heavy cable fastened to "dead men" or sleepers sunk deep in the earth. This severe baptism, added to the dreadful battering she received during the christening, makes her quite a seasoned ship. The champagne bottle used by Miss Masson, chosen at random from the two million in her father's cellar, in Hammondsport, was so thick and strong that, after two throws by her against the bow, and two violent throws by Lieut. Porte, it had to be tied and struck with a sledge before it would spray the hull. The "America" is now ready for the buffeting of the Atlantic.

The Austrian Aircraft Disaster

By Carl Dienstbach

COLLISIONS in the air have occurred between aeroplanes, but the most recent disastrous encounter of a dirigible and a flying machine is a ghastly novelty, not only because of the appalling loss of life, but also because of its similarity to collisions at sea, which have resulted from imperfectly understood conditions of maneuvering. The tragic sight of the occurrence near Vienna is not lightened by the fact that the military necessity of the kind of maneuvering from which it resulted was more imaginary than real, and that scientific thought could have revealed its dangers before they had been proved by bitter experience. Only obsolete dirigibles hold out a temptation for a sudden attack by aeroplanes from above at close quarters, a proceeding which has been characterized in the columns of the SCIENTIFIC AMERICAN as suicidal, even if it succeeds, and of which the danger has now been so glaringly brought home.

All large dirigibles are now provided with armored platforms as a defense against overhead attack, platforms which are reached by air-tight vertical passages with ladders, traversing the very gas. But it is a serious oversight not to realize that the same defense may be easily improvised on any smaller airship of an earlier date. To see a man climb up the side, and even to the top of a spherical balloon—with the netting for a ladder—during inflation, to fasten a flag or adjust something is common enough; similar feats have been performed several thousand feet above ground. The weight of a small man with a Lewis machine rifle is still more easily supported by the tougher envelope and internal pressure of a dirigible. It requires only the lightest kind of a "saddle" frame (distributing the weight over a considerable area of fabric) to shelter the men very snugly and keep a rope ladder at a convenient distance of one inch or two from the gas bag, not to forget a speaking tube or signaling apparatus for communication with the car below. Although it is but a single marksman to whom the overhead protection of a small, old-fashioned dirigible be thus entrusted, his presence is quite sufficient to stamp any maneuvering of an aeroplane to get into efficient bomb-dropping range as equally ridiculous as assaulting with a dagger an expert with an automatic pistol. If the upper half of the dirigible is deserted—a negligence quite as ridiculous in war as it would be to fight a torpedo-boat with no opening and a high fence on the starboard side—there is, indeed, a strong temptation for an attacking aeroplane to get into this lee-zone of invisibility. When this was done without warlike intent by an aeroplane, which had gone out to greet an arriving Parseval dirigible, the experienced pilot of the latter published a passionate protest, "because nobody could know what might be the result." Assuredly, warlike conditions must needs increase the danger out of all proportion. In the case of the ill-fated Austrian craft, it was evidently assumed that the dirigible was defended by firearms *in the car*. The tactics of the attacking aeroplane were, accordingly, correct enough from a military point of view, but a scientist could have foretold their risk. The newspaper report that the biplane rose to a much higher level just before attempting to fly over the dirigible seems correct, as close-range fire could best be dodged by swooping.

But the maneuver resembled a landing, and Hirth, the German engineer-aviator, has eloquently described the chance of a premature contact with the ground, due to the difficulty of judging its exact distance, the amount of downward momentum, and, principally, how the contour of the ground might unexpectedly deflect the wind and sway the machine. The Austrian "Koerting," airship type, which figured in the accident, is characterized by a "camel-back," an exaggerated curving of the upper side of the hull, resulting in a tremendous suction like that above the upper surface of an aeroplane. We know what the "suction" of a hull of normal shape has done to ships on the water in bringing them into collision without any gravity to help. How much greater be that danger with one of them "all surface," like an aeroplane?

What happened to the unforunate Austrian aviators was evidently that they felt themselves dropping into the worst kind of an "airhole" right above the dirigible. The slightest contact with the gas bag meant their inevitably firing a mine. The envelope had no more resistance to oppose the momentum than so much tissue paper. The uprush of the mass of hydrogen, liberated under pressure, is only too obvious.

But what no one seems as yet to realize is that it required no far-fetched "spark from the motor" to fire the explosive mixture generated as quickly as in a carbureter. In place of one spark, there were half a score of torches of blue flame spurting from the motor's exhaust. In daylight these are hidden from view, but in twilight they have frightened more than one passenger. (The first impulse of the dropping pilot was, naturally, to aid escaping by running his motor full blast.)

To the many reasons for carrying a muffler, this disaster has added a queer and ominous one. To "rush" a dirigible with open exhaust might be resorted to by those who want to die killing. But, with all its extreme vulnerability, the dirigible commands a protection like steel armor in its superior facility for the highest type of marksmanship. Aeroplanes should keep away from dirigibles when they need "elbow room," even in ordinary balancing. Whoever remembers small craft rocking in the wake of a steamer will be ready to grasp the fundamental truth that the invisible disturbance in the atmosphere from the huge bulk of a dirigible may extend to an unsuspected distance. If one remembers the danger to aeroplanes, even at a good height above them, of large detached buildings on the ground in a wind, the complication of a big dirigible, always of great inertia, an aeroplane, and possible wind gusts seem appalling, and the Austrian meneuvers more than foolhardy.

To extricate himself of well-nigh unavoidable miscalculations of the relative strength of momentum, gravity, and the uncertain amount of aerial support or resistance to be encountered near a dirigible, an aviator would need a reserve of propelling force that the most ingenious designer could hardly place at his disposal. Without it he could not possibly know just how long it would take to get about and be liable to bump into the dirigible when he felt most certain of dodging it. If speed is frequently miscalculated on the water, correct maneuvering in a "tight place" seems almost out of question in the air—unless flying machines be made, like birds, far more independent from inertia and momentum than are ships.

Ulivi's Experiments in Exploding Bombs With Infra-red Rays

THE press of Europe has much to say to-day about the experiments of the Italian engineer, Giulio Ulivi, who is said to be exploding bombs from a distance by means of the infra-red ray. The public exhibition in Florence a month ago, where four bombs floating on the surface of the River Arno were exploded in succession, has attracted much discussion. The SCIENTIFIC AMERICAN, in order that its readers may be in the current of popular opinion in the matter, presents an eye-witness story by a representative of the *Corriere della Sera* of Milan. The accounts lack the precision of scientific ones and are defective in just those places that a physicist particularly desires more information, but they seem to present a matter that is taken seriously in some quarters. It is evident that there is here either a belief on the part of the experimenter in his results or a splendidly well-staged act in necromancy. It is well further to say that there have been previous "demonstrations" by another which have some resemblance to these. They have been regarded with suspicion in scientific circles.

Ulivi chose for his assistant, Admiral Fornari, who at 9 o'clock one evening was rowed from the iron bridge into the middle of the Arno, placing in the water one after the other the four bombs. The fact of the immersion was communicated to Ulivi by means of flashes of light, and the return of the admiral to the river bank was also signaled.

The lights served to notify the Florentines of what was on foot, and in great numbers they gathered on the Lungarno. The houses along the river were teeming with population, even to their roofs. Carriages, autos, and trams carried unceasingly their passengers to the river and streams of pedestrians had the same goal. Some went to Monte Senario, where Ulivi had stationed himself. Accompanying Admiral Fornari were officers and engineers invited by the Minister of War to view the experiment.

"All at once," according to the *Corriere*, "the darkness was rent by a blinding flash, there was an explosion with a shower of sparks and these lighted a cloud of smoke that for a while hung over the river." In a quarter of an hour the second bomb was fired, and after about an equal interval, the third. The bombs had been floating with the current and here a delay ensued. When about twenty minutes had elapsed the people thought that the last bomb had escaped, but near the bridge of the Graces it was located and a fourth detonation announced the complete success of the experiments.

It is represented that Ulivi wished to introduce the greatest difficulties and did not make up the bombs in the usual manner. He had already proved that glass and ebonite are transparent to the "radio-ballistic" rays and employed other insulators. The powder was inclosed in a capsule of gutta-percha and this in fiber, which another portion of the story suggests was waxed cord. Outside there was a sphere of porcelain, this incased in asbestos cardboard, and finally to inclose the whole, a jacket of wrought iron.

The bombs thus constructed could float about two thirds immersed. There is the claim that flotation is not necessary, and that the bombs could have been sunk to the bottom or buried in the earth without changing the results. But for such a public demonstration the safety of the spectators could be better assured by the method adopted.

The distance from the river to Monte Senario, where Ulivi stationed himself, is ten and one third miles, and intervening are Fiesoli and the plain of the Arno. When the signals were received that the bombs were placed and the admiral ashore again, the engineer began at once to send forth his "spy-rays."

The popular description of the devices employed suggests two operations, the sending forth of the electrical "spy-rays," which diffuse themselves in all directions, and the production of infra-red rays. Other items in the outfit are a telemeter, a wireless apparatus for messages, a voltmeter, an ammeter, and a chronometer. In addition there is a battery which furnishes the energy for the action of the apparatus.

In operating, the "spy-rays" are first sent forth. When they encounter a metallic mass they free from it what may be termed, "return rays." On analysis the latter indicate with some precision to the operator, who has his head incased in a telephone helmet, the amount of metal, its radio-magnetic effect and the distance at which it lies. The operator then directs the infra-red rays which he produces toward the metallic object. As they pass through it they produce scintillations, or as he terms them, "M-rays," which ignite the explosive.

If this story is really true, the possibilities are inconceivable. In offensive warfare Ulivi claims to be able to destroy forts, ships, and magazines, if they contain explosives, and practically eleminate war. On the other hand, if mineral veins or lodes can be thus detected there will be a most useful extension of the arts of peace.

Ulivi, born in Tuscany, achieved distinction at the Technical Institute of Florence, was made laureate in Germany, and established himself in France some years ago, and afterward set up a physical research laboratory at Clichy. In working with the infra-red rays of the spectrum, he discovered strange phenomena that these waves produced at a distance. He found that in a stable, some hundreds of feet from his laboratory, the iron horseshoes produced electrical scintillations when under the influence of the infra-red rays. He referred the phenomenon to comparable ones in the production by one musical instrument of sympathetic tones in another instrument. With this idea of sympathetic vibrations he experimented with light, electricity, magnetism, and heat, and the transformation of one into the other. The outcome of these researches has been the ability to explode charges that are within metallic walls. This explanation, although it is set forth as the presentation of the "fundamental theory," leaves much to be desired in the completeness and relevancy of its statements.

Meteorology in Eastern Siberia

THE new meteorological observatory at Vladivostok is to be the center of an extensive network of observing stations in Eastern Siberia, which will report their observations by telegraph, and co-operate in maintaining a storm-warning and general forecasting service. A grant of about $130,000 has just been asked from the Duma for the establishment and equipment of these stations. In connection with important colonization plans, the government of Yeniseisk has just published a large work (in Russian) on the climate of Eastern Siberia, accompanied by an atlas. This gives detailed statistics for most of the government of Tomsk, and the whole of the governments of Irkutsk and Transbaikalia. Increased knowledge of the Siberian climate is of practical interest to Americans in connection with the work of introducing plants from that region into the United States, and finding the most appropriate habitat for them in this country.

M. E. Durand-Gréville, the French meteorologist, died in Paris January 2nd, in his 76th year. His principal scientific work was the development of the law of squalls, and the bulk of his writings relate to this subject.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Postage Stamp Mucilage

To the Editor of the SCIENTIFIC AMERICAN:

I read a very interesting article in one of your recent issues relative to the Government's new machine for the manufacture of postage stamps, and it occurs to me, in that connection, that something should be devised whereby these postage stamps could be so gummed that the stamps would adhere to the envelopes to their journey's end.

Seriously, we have great difficulty in this regard. The mucilage used is so light in character that it does not hold, and the slightest over-moistening of the stamps seems to take all the sticking qualities away.

New York. W. W. HALLOCK.

The Inventor of the Bicycle Prop

To the Editor of the SCIENTIFIC AMERICAN:

I wish to call your attention to the fact that the "Prop for Bicycles" shown in your issue of June 13th, on page 489, was patented by me on April 9th, 1895. For confirmation of this please refer to patent No. 537,-147, where you will find description of this device, in what I think a much more practical form than that shown in your illustration.

I claim to be the oldest or longest continuous subscriber on your books. My subscription began in 1866 or 1867, and has been continuous ever since for the SCIENTIFIC AMERICAN. I am quite sure, too, that I began with the beginning of the SUPPLEMENT, and also the Building Edition. JOSIAH B. GATHRIGHT.

Louisville, Ky.

The Foucault Experiment

To the Editor of the SCIENTIFIC AMERICAN:

Being a reader of your useful and instructive paper during a period of over fifty years, I always noticed that you are just, and invariably give credit to whom credit is due. Permit me, therefore, to mention and amend Mr. Edward Sillig's letter from Vevey, Switzerland, in your last edition, that the *second* "successful demonstration of Foucault's experiment," watching the world revolve, was made in 1854, at Carlsruhe, Germany, by W. Eisenlohr, professor of physics at the famous Polytechnic Institute, while I was a student there. The demonstration was made in a high church close to the professor's lecture rooms. The late beloved F. Redtenbacher, professor of mechanical engineering, advised in the construction of the *universal joint* from where the pendulum was suspended to swing independently of the earth's motion. ROBERT KUNSTMAN,

Little Rock, Ark. Consulting Engineer.

Sir Joseph Swan's Electric Incandescent Lamp

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to call your attention to the fact that some erroneous statements were made in the article "The Death of Sir Joseph Swan," which appeared in a recent issue.

You state that Swan's "first lamp had a carbon filament." Such is not the fact, however. His first lamps had small *rods* of carbon for burners.

The famous lawsuits on the incandescent lamp in England and the United States were decided in favor of Edison, giving him priority over all others as the inventor of an incandescent electric lamp having a *filament* of carbon as a burner.

Orange, N. J. WILLIAM H. MEADOWCROFT.

Absence of Frosts on the Rand, Johannesburg

To the Editor of the SCIENTIFIC AMERICAN:

With reference to an article on a "Dumping Conveyor at the Brakpan Gold Mines, Johannesburg," in your most interesting and highly valued paper (Vol. CX, No. 12, of March 21st, 1914), I beg to draw your attention to a statement in this article which reads as follows: " . . . The total absence of frosts in the Rand district does away with the danger of handling moist sand, which is always present in our own climate. . . . . ." I am a South African born [not colored, please], and have lived ten years on the Rand (which word, by the way, i. e., Rand, means "Ridge," having been adopted from the Dutch), and have always *seen*, as well as *felt*, the very severe frosts up here—often accompanied by cutting winds and clouds of red dust, besides the white dust from the dumps; so it was with great surprise that I saw the above statement in your paper.

Here is an abstract from the *Union* (Government) *Astronomer*, which speaks of the frosts up here:

"Frosts are experienced in Johannesburg and at Brakpan every winter, I believe, without exception. At the observatory we have had one or two winters without frost, that is, because of its peculiar situation. Our absolute minimum in the shade was 23.1 degrees on July 16th, 1906, and during last year the following are the minimum temperatures recorded from June to September: 31.5 degrees on June 8th, 1913; 31.2 degrees on July 15th, 1913; 27.5 degrees on August 14th, 1913; 30 degrees on September 4th, 1913; which will show you that frosts occurred in each of these four months.

"R. T. A. INNES, Union Astronomer."

In conclusion, I may add that we had about four inches of snow here about five years ago, and about eleven years ago the fountain in Johannesburg, Joubert Park, *was frozen solid*, long icicles hanging in the air!

M. D. WALES [Clerk of Court].

Krugersdorp, Transvaal Province, Union of South Africa.

Misinterpreted Wireless Signals

To the Editor of the SCIENTIFIC AMERICAN:

I have noticed with much interest the several letters that you have published under the heading "Correspondence" with reference to the misinterpreted wireless signals sent out by the steamship "Siberia" some time ago, and which, at the time, caused so much excitement in the newspapers.

I quite agree with Mr. Wiley that the call "M B S" might very easily be confused with "S O S," especially if one did not happen to hear the first letter or two after the attention signal. It seems to be natural, and a failing inherent in all operators, to run the letters of a call together, and as the station called is always able to recognize its own letters, no matter how much they may be run together, this ordinarily makes no difference.

However, the point I wish to make now is that I have searched the official list of radio-stations issued by the International Radiotelegraph Bureau of Berne, third edition, June, 1913, and all supplements that have been issued up to the present time, and fail to find any ship with the call "M B S," so I wonder whether or not, after all, the misinterpreted signals have really been explained! H. A. FOWLER.

Kansas City, Mo.

How Vessels May Communicate With Each Other in a Fog and at Night

To the Editor of the SCIENTIFIC AMERICAN:

Like many others, my mind has dwelt on this fog problem at sea during the last few days. I have been familiar with electrical inventions all my life, and it does seem to me possible to perfect a simple device by which vessels at sea could be made aware of their proximity to each other. As I think it out, this device could be made to give almost exact information as to distance apart, and whether ships are approaching or moving away from each other.

I base my calculations on my attention to the impressions made by light and sound during thunderstorms. I have often sat calculating the distance of the storm center, and measuring its approach and its passing, by the time distance between flash and thunder. A stop-watch started and stopped makes the calculations of distance quite accurate. In the case of the device I have in mind, I would make the wireless dot or dash take the place of the lightning flash. While the lightning flash could not be seen through a fog, the wireless and sound waves would not be affected.

Suppose a whistle, fog horn, or gun so connected with the wireless operator's instrument that the touching of his key would release at exactly the same instant the spark for the wireless instrument and the sound of whistle, horn, or gun. The operator on the other ship would receive the wireless instantly, just as I received the lightning flash, while the sound would follow at the comparatively slow rate of about 1,100 feet per second, as the sound of thunder. For every second between the receipt of the wireless spark and the receipt of the sound the operator would know that there was 1,100 feet of space between the vessels. A signal of this kind sent out once every ten seconds would cover a radius of nearly two miles. The velocity of the wind would make a difference not difficult to calculate.

To give exact information as to approach or separation of vessels, the following device could be used. Devise an instrument to be worked like a stock-ticker with traveling ribbon. Arrange that this ribbon shall travel at, say, the rate of one inch per second. Each inch would represent 1,100 feet of sound travel. The ribbon could be scaled off to represent shorter distances if necessary. Then arrange a series of dots or dashes to represent on this ribbon the receipt of the wireless waves and sound waves. As vessels approach each other, or as vessels approach wireless land stations, the dots and dashes would indicate the fact by crowding up together on the ribbon. For instance, if the signals were first received at a distance of two miles, the dots or dashes would be about ten inches apart on the ribbon; when a mile apart this distance would be represented by a space of five inches between dots or dashes, and so on. As vessels move away from each other, or from a wireless station on shore, the dots and dashes would thin out on the ribbon. If the vessels were moving in the same direction, alongside, the dots and dashes would remain an equal distance apart. If such an instrument could not be operated by the wireless or sound waves, the wireless operator could easily manipulate it through his own sense of hearing. I believe that the use of this method would enable a vessel in distress to guide a rescuing vessel alongside, no matter how black the night or thick the fog.

Any navigator could send a signal of this character without special apparatus other than the wireless. For instance, the captain could instruct his wireless operator to send a signal the instant the whistle begins to blow. The operator on the other ship could report back the time interval between the receipt of the wireless and receipt of the whistle, which would give the distance separating the ships exactly. The distance could be calculated as so many seconds and fractions of seconds, each second being equivalent to 1,100 feet.

I have talked with a number of people on this subject, and the prevailing opinion seems to be that my idea is practicable, and can be worked out. If you think this scheme would stimulate other minds to action in solving the fog problem, I have no objection to your publishing it. It would be far better to have hundreds of minds working on this problem than perhaps only a few. J. B. WEST.

Syracuse, N. Y.

The Pioneer Steamship in European Waters

To the Editor of the SCIENTIFIC AMERICAN:

In your interesting article, "The New Cunarder Aquitania," in the June 6th issue of the SCIENTIFIC AMERICAN, I noticed you mention "the launch of the pioneer steamship in European waters—Bell's 'Comet,' which was launched in 1812."

On a table in the Merchants' Exchange, in San Francisco, there reposes in a glass case a worm-eaten fragment of oak, bearing a legend stating, in effect, that it is a relic of the "Charlotte Dundas," a steamboat built at Grangemouth, Scotland, and launched in 1801 by William Symington. She was a sternwheel boat, about fifty-seven feet long, the wheel being inclosed in a case at the stern, and was employed in towing barges on the Forth and Clyde Canal. Her speed was about eight miles per hour. She antedated Bell's "Comet" by eleven years and Fulton's boat by six years. The "Charlotte Dundas" was a distinct success, but owing to certain hostile "interests"—there seem to have been "interests" even in those days—she was withdrawn from active service.

It is one of the fallacies of history that Fulton was the pioneer in steamboat construction. He was present at the trial trip of the "Charlotte Dundas" in 1801, and did not launch the "Clermont" until 1807. In fact, some of the material of which the "Clermont" was built was shipped to Fulton from the same yard where the "Charlotte Dundas" had been built six years previously.

A steamboat was launched on the Delaware by John Fitch, in 1787, I believe, but did not prove a success. To whom belongs the honor of first conceiving the idea of a vessel propelled by steam is difficult to say. Pepin, a Frenchman, is said to have experimented with one on the Seine some time in the seventeenth century, but there is little doubt that William Symington was the actual pioneer in practical steamboat construction. Recorded facts will, I am sure, verify these statements.

San Francisco, Cal. A. E. ACKLOM.

[Although Fulton in America, and Bell in Great Britain were the first to inaugurate a successful passenger-carrying service in their respective countries, Symington, with his "Charlotte Dundas," built the first successful steam tug, and this as early as 1801. Furthermore, had Symington received the necessary backing, we have no doubt he would have been the first to build and operate a successful passenger steamship. That he was a skilled and qualified engineer is shown in the excellent design of his tow-boat. This vessel and other pioneer boats, such as that of Fitch, were illustrated and described in our Hudson-Fulton issue of September 25th, 1909.—EDITOR.]

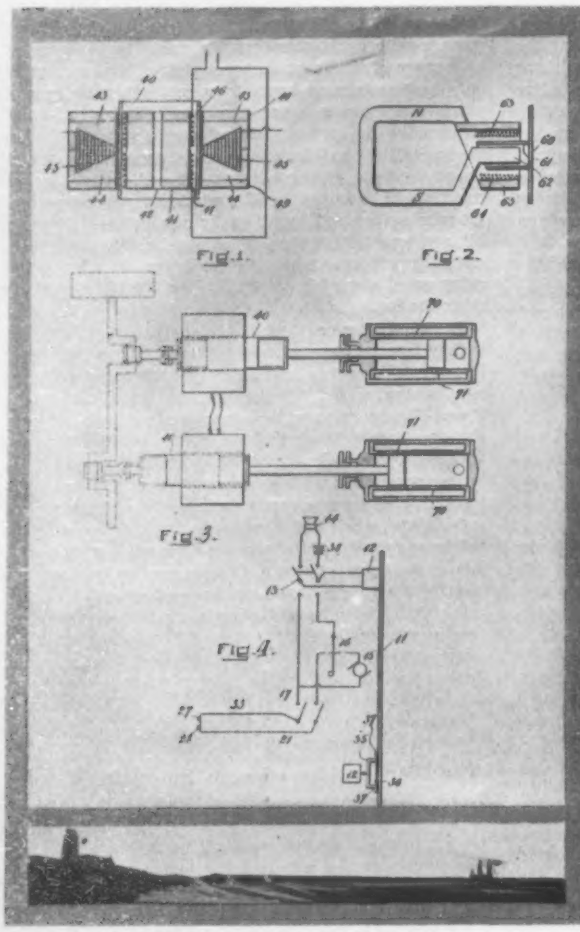
What Power Does It Take to Stop an Automobile?

To the Editor of the SCIENTIFIC AMERICAN:

Please state in some intelligible figures what it will take, in weight or power, to stop an automobile weighing 3,500 pounds, traveling 20 miles an hour, within 30 feet. X. Y. Z.

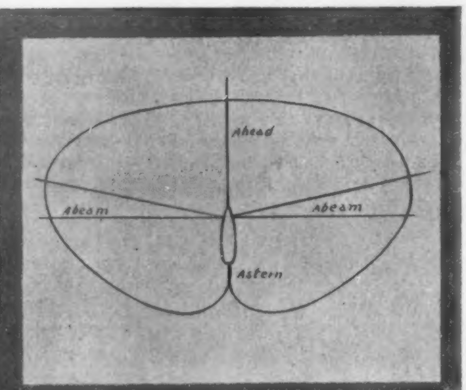
New York.

[Simple as the problem propounded by our correspondent is, it is curious how many different solutions are given by persons who are presumably familiar with the principles of physics. We shall be glad to hear from our readers on the problem.—EDITOR.]



Various applications of the Fessenden electric oscillator.

Prof. Reginald Fessenden and his electric oscillator.



Tank attached to skin of ship for receiving submarine signals.

An Underwater Siren to Prevent Collisions at Sea

Prof. R. A. Fessenden's Latest Invention

By P. Harvey Middleton

BEFORE describing the oscillator invented by Prof. R. A. Fessenden, which has made it possible, for the first time in the history of navigation, for moving ships to communicate with each other in the densest fogs with absolute certainty, and to obtain an echo from an iceberg, it is necessary to recall briefly the history of the submarine bell, which first made it possible for ships to receive sounds through the water, though not to send them. Jules Verne in his "Twenty Thousand Leagues Under the Sea" makes Capt. Nemo of the "Nautilus" dwell upon the superiority of submarine transmission, and there have been many attempts to utilize the principle; the natives of Ceylon over a hundred years ago used to signal each other when at sea by submerging an earthen "chatty," which, when struck, produced a sharp, percussive clink that could be heard by placing the ear against the bottom of a boat miles away. After persistent and long-continued experiment in the utilization of improved electrical microphonic and telephonic apparatus, the first submarine bell was installed at Egg Rock, on the Massachusetts coast, in 1901, and three years later the first receiving apparatus was fitted upon an ocean-going steamer. Now there are 148 bell stations in the world, and 1,225 war and mercantile vessels have apparatus for receiving the sound from these bells, this apparatus consisting of (1) an indicator box containing switches for connecting alternately the microphones of the system with the telephone receivers, (2) dry batteries for supplying electric current for the telephones, (3) microphones for transmitting the bell sounds to the telephone, and (4) tanks to contain water in which the microphones are immersed.

The man who deserves the highest credit for the idea of installing a microphone for transmitting sound in a tank on board ship is the late Arthur J. Mundy. Realizing that sound travels through water at 4,700 feet per second, against 1,090 feet through air, and that submarine signals are not subject to interferences such as frequently occur with atmospheric sound signals, Mundy conceived the idea of building a tank on board ship in such a way that the hull would form one end of the tank, which was filled with sea water, the side of the ship offering no impediment to the passage of sound through the water.

But the problem which still remained and has only now been solved, was to devise an apparatus that would send out powerful signals from a moving ship, and of a selective receiving apparatus which would make it possible for the ships of a fleet or merchant vessels to signal each other without interference. You see, the existing submarine bell only made it possible for a moving ship to hear the sounds made by a stationary bell or a stationary ship. The one thing which all ships have lacked has been a means of making a noise in the water, while in motion, which other vessels could hear, and by which they could locate each other, irrespective of weather conditions.

There have been many attempts in the past five years to invent something which would create a powerful enough sound in a tank on board ship to penetrate through water at considerable distances. Prof. R. A. Fessenden has now perfected an oscillator which can be attached to the inside hull of a ship below the waterline, and which produces a sustained note of any desired pitch. It is controlled electrically, and by using an ordinary telegraphic key, messages can be sent by the Morse alphabet. Moving vessels can now communicate with each other and exchange signals under water at considerable distances in the thickest fogs, as well as receive signals made by bells on buoys, lightships, or ships at sea. It will do in fog what light does in clear weather—tell a ship where the danger is, in ample time to avoid it.

Patents have been applied for and granted in several countries. The following description of the apparatus is taken from the French patent:

The Principles of Prof. Fessenden's Oscillator.

Prof. Fessenden's oscillator serves to produce, utilize, transmit, or receive compressive waves, such as are employed in the transmission of submarine signals.

Fig. 1 is a sectional view of an electrodynamic oscillator built according to Prof. Fessenden's plans, and intended to act either as a motor or as a generator. Fig. 2 is a diagram of a telephone receiver in which the principle of the invention is embodied, but the field of which is produced by a permanent magnet. Fig. 3 is a diagram showing the mode of energizing the oscillating conductor by means of a gas engine. Fig. 4 is a diagram showing the invention applied to the transmission and the reception of submarine signals.

In Fig. 1 the oscillating conductor 40 is shown in the form of a copper cylinder, and 45 is the magnetizing coil of an electromagnet, having north and south poles, 43 and 44. The central core is indicated by 41. Figs. 46 and 47 indicate the two windings of the stationary coil, constituting one of the elements of the transformer (of which the oscillating cylinder 40 constitutes the other) and connected with an external circuit.

The magnetic flux passes from the pole 43, through the cylinder 40 to the upper half of the armature or core 41, thence from the lower half of the core to the pole 44, and by way of the external ring, back to the pole 43. That part of the cylinder 40 which extends beyond the two windings 46, 47, is vertically grooved or otherwise formed to attain high resistance. The coil 46, 47 is preferably wound on the core 41, although it might be placed within the poles 43, 44. The upper and lower windings of this coil run in opposite directions, so that the current induced in the cylinder 40 may be such that the force exercised on the upper and lower parts of the cylinder will be of the same sign. Hence, the cylinder 40 can always be cut into two halves, and the windings 46, 47, can be given the same sign; the two halves of the cylinder then move in opposite signs, so that no unbalanced inertia effects will be produced.

The core 41 and the poles 43 and 44 are preferably grooved vertically, in order to avoid eddy currents. The plates 48 and 49 serve to hold the pole pieces of the electromagnet and the core together. The core 41 is provided with an opening 42.

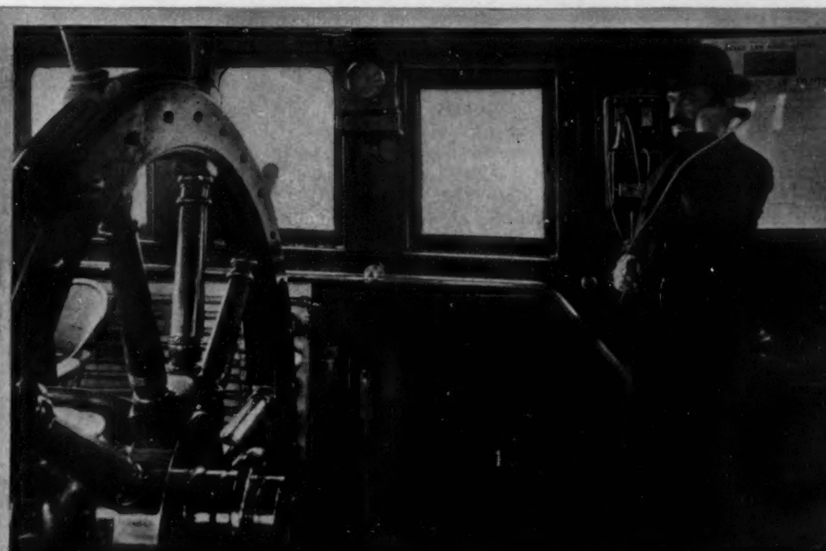
When an alternating current having a frequency of 1,000, for example, is passed through the coil 46 and 47, the cylinder 40 acts as a short-circuited secondary, in which is induced the same number of ampere turns as in the coil. Because of the gap, which may have 15,000 lines per square centimeter, the current is raised and lowered with great force, the path being of any desired length. If the side of a ship or the rod of a locomotive piston were fixed to the extremities of the cylinder 40, they would be thrown into movement.

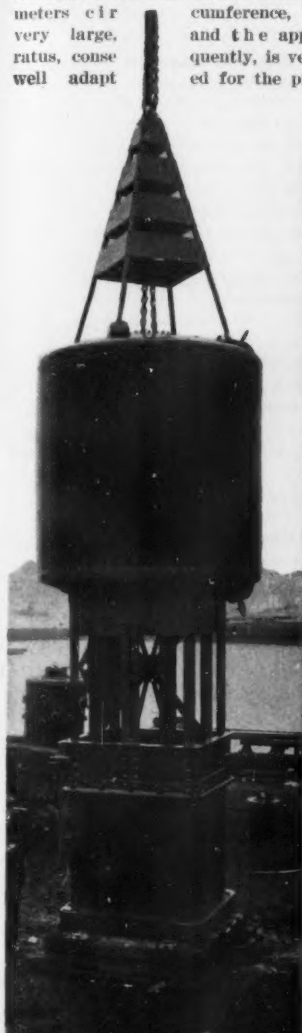
The motor, in this form, has this great advantage over all other alternating current motors: as a result of short-circuiting the cylinder 40 and of the inductive reaction on the coils 46, 47, there is no hysteresis, no inductance, no eddy currents in the electromagnetic metal. At a frequency of 1,000 and a resistance of 4 ohms for the windings, 86 volts will be made to pass 20 amperes through the circuit, assuring a very high

power factor, even when the cylinder 40 is at rest. When the cylinder is permitted to move, the power factor approaches unity. The power that can be obtained with this apparatus of comparatively small dimensions, for example, a cylinder 40, of 60 centimeters circumference, is very large, and the apparatus, consequently, is very well adapted for the production of submarine signals. If the flux is 15,000, the circumference 60 centimeters, and the amperes 24,000, the total force will exceed 2,032 kilograms. The cylinder will weigh about 5 kilograms, and such a force applied to this mass will give an acceleration of more than 4,000 meters per second. If, then, this force is applied to the given mass for a second, the speed obtained will be more than four times as great as that of a projectile discharged from a gun with ordinary powder. This power is of a very different order than that which has hitherto been obtained, and it is

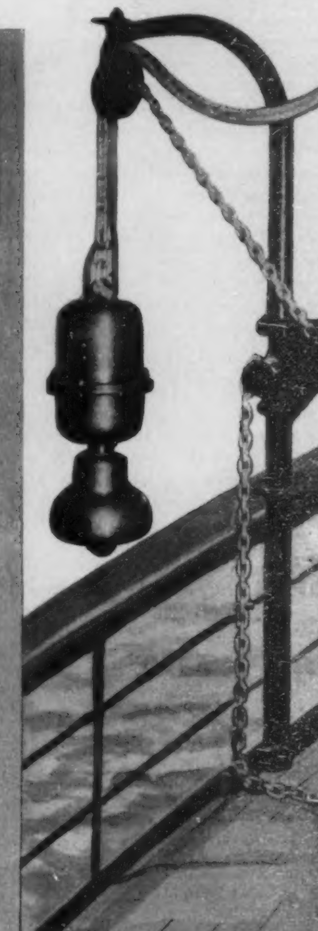
Receiving a submarine signal.

Chart room of the "James S. Whitney" of the Metropolitan Line, running between New York and Boston. This shows the indicator box, by means of which the officer can compare the bell sound on the starboard side with that on the port, by turning a switch, which disconnects one side and connects the other. There are two ear-pieces, so that an operator may have a receiver at each ear, or two operators can share the service, so as to correct their observations. The Fessenden oscillator will be connected to these indicator boxes. The "James S. Whitney" was one of the steamers used in submarine signal experiments conducted for members of the United States Lighthouse Board.





Submarine bell-buoy for Swakopmund, Southwest Africa.



Submarine signal apparatus.

Outboard gear installed on a lightship. The bell hangs down 25 feet under water.

Submarine bell cable landing at Chebucto Head, Halifax.

On account of the severe storms at this point, a rail had to be used to hold cable in position. There are now 148 bell stations in the world, and 1,225 war and mercantile vessels have apparatus for receiving the sound from these bells.

The United States revenue cutter "Miami" close to berg (off Grand Banks) similar to that which destroyed the "Titanic."

The Fessenden oscillator obtained echoes from icebergs two and a half miles away, distance being determined by stop-watch. Had the "Titanic" been equipped with an apparatus capable of ascertaining the presence and distance of the iceberg, she might have been saved.

possible only because of the powerful connection between the two elements of the transformer. The time constant is very small, because of the feeble self-induction of the oscillator, due to the mutual neutralizing action of the primary and the secondary.

In Fig. 2 another construction is shown, adapted for telephone use. The diaphragm of the telephone is indicated by 60; 61 is the cylinder or oscillating tube. *N.S.* is a permanent magnet, one of the poles of which constitutes the core 62, and the other pole 63 is of a circular form and incloses the stationary coil 64. In this case only a single gap is employed, since the magnetic lines pass between the pole or central core and the exterior concentric annular pole. When the currents coming from a microphone pass through the coil 64, the tube 61 vibrates, and the diaphragm 60 to which it is fixed reproduces the sound.

Fig. 3 is a diagram of the oscillator in the form of an alternating-current generator, two connected oscillators being energized by two pistons 71, acting in opposite directions in the cylinders 70, and each piston being connected with an oscillating cylinder 40. When a certain number of these units is employed, they can be connected in parallel, and the synchronization is such that neither a crankshaft nor a flywheel is necessary; control is effected simply by regulating the ignition. In adopting this novel construction an obstacle is overcome, which prevents the employment of oscillating dynamos, that is to say, the carrying along of the lines of force with the movement of the conductor. This is true to such a degree that the telephone receiver shown (Fig. 2) is much more sensitive to equal movements than any carbon microphone. The absence of this carrying along of magnetic lines and of inductance and hysteresis adapt it splendidly for syntonization. Such microphones can be connected in series or in parallel, which cannot be done with carbon microphones, because of the difference in phase.

Fig. 4 shows the application of the oscillator for submarine signaling. The apparatus is mounted directly on the plating 11 of a ship. If preferred, a diaphragm may be inserted in an opening made in the side of the ship, or the diaphragm may be fixed to the side of the ship, within the hold, the space between the diaphragm and the side of the ship being filled with water or with some other liquid, such as oil, which can be put under pressure. Instead of a liquid, a compressed gas can be employed, such as air or carbon dioxide. This diaphragm 35 is shown fixed to the inner side of the plating 11 of the ship; 36 is the fluid, and 37 a rubber guard ring. The diaphragm can be so constructed that, when it is touched, it will vibrate for some time. The apparatus 12, mounted on the plating of the ship, is similar to that shown in Fig. 1. When the switch 13 is thrown and the key 16 is depressed or moved to the right, the current from the alternator, or from the source of intermittent current 15, passes into the apparatus 12, and causes the cylinder 40 (Fig. 1) to vibrate powerfully. The cylinder being fixed to the plating 11 of the ship, directly or indirectly, as when it is mounted on the diaphragm 35, or secured to a rod or a spring, produces in the water, outside of the ship, compressive waves similar to acoustic waves in the air, which are transmitted and received at the receiving station. The waves thus transmitted may be of any desired frequency, from five to several thousand per second. In practice, the frequency is preferably determined by the frequency of the source 15. The key 16 may be employed for signaling, as in the case of ordinary telegraphy. When the switch 13 is raised, the apparatus 12 is placed in circuit with the battery 38 and the regulator 14, which may be a carbon telephone transmitter in which strong currents are used, or a transmitter and relay.

Telephonic communication through water is effected by speaking into the transmitter 14. When the switch 13 is lowered and the switch 17 is raised, and when the key 16 is raised (moved to the left), the apparatus 12 is connected with the receiving circuit. In this position, when the compressive waves, coming from some other station, are projected against the side 11 of the ship, they move the plating, carrying with them the cylinder 40, and the movement of this cylinder generates in the coils 46 and 47 (Fig. 1) currents which actuate the receivers 27 and 28. The current entering at the right side of the switch 17 and of the switch 21 passes through the receivers 27 and 28, which are in series, and returns through the conductor 33. Instead of switches, one may use the ordinary telephone circuit of land lines.

Some Remarkable Tests.

The first tests of this oscillator were made on the battleship "Delaware" in March, 1913; later tests being carried out on the United States submarines "D-2" and "D-3." The sound is produced in the oscillator by the vibration of the diaphragm, this motion being given by electrical impulses induced in a copper cylinder inside the casing, which hangs free in an electromagnet. The accompanying diagram shows the principle clearly. The motion, only 1/100th of an inch in length, is given at the rate of 500 per second, making a musical note. The receiving oscillator is precisely like the sending one, the action being merely reversed, and the diaphragm exciting the telephonic apparatus within as it receives vibrations from the water. In regular service the oscillator will either be attached to the side of a tank on board, filled with sea water, the side of the ship forming one end of the tank, or else it will be set in the side of the ship as a diaphragm, that is to say, a hole will be cut in the side of the ship as large as the oscillator, and the latter will be set right into the hole.

On June 3rd a test was made in sending messages from the collier "Devereaux," off Cape Cod, to the "Neponset" tug, lying off Boston Lightship, with Prof. Fessenden on board the latter. The "Neponset" was equipped with a receiving oscillator, hung overboard from a davit. About 9:30 P. M. the unmistakable note of the oscillator on the "Devereaux" was heard, carried under water all the way across Massachusetts Bay, her distance being approximately determined by the volume of sound received. The Morse dot-and-dash sounds could be heard perfectly in the forecastle of the tug, beneath the water-line, even without the aid of the receiver at the ear. The steamer "King Philip," nearby, with a fishing party on board, came over to the lightship, her captain much mystified, because his men in the forecastle reported hearing dots and dashes coming from an unknown quarter.

Earlier on the same day an even more surprising demonstration had been carried out with two tugs tethered in tandem fashion to the Boston lightship, communication having been established by the sound of the human voice transmitted under water—the first successful experiment of wireless submarine talking. The distance, of course, was very short, but Prof. Fessenden has high hopes of its further development.

On June 10th the writer met Prof. Fessenden in Boston, and witnessed a demonstration with an oscillator attached to the end of an oblong iron tank filled with water, there being an open space of about eight inches between the oscillator and the tank, a wire running from the oscillator to a Morse telegraph key on a table. The professor tapped out a message on the key, and the vibrations communicated to the tank were so powerful that the water sprayed up from the four sides like a miniature fountain, the note produced being almost deafening in the small room. Then the professor shut himself up in a small office at the far end of the workshops, and placed a Melba record on a talking machine, the writer remaining in the room with the oscillator. Immediately the strains of "La Serenata" ascended apparently from the center of the tank, and when the ear was placed on the iron side of the tank, the voice came clear and distinct, apparently through the metal. As a final experiment, Prof. Fessenden asked the writer to go into the room at the end of the shop, close the door, and listen at a telephone receiver hung on the wall, while he stood in front of the oscillator and delivered a short speech. In this case, too, the voice was clear, though seeming to come from a long distance.

Prof. Fessenden declares that the oscillator's note has already been heard thirty-one miles through the water, and its note cannot be mistaken for the sound made by any screws, machinery, or bell.

Disasters That Could Have Been or Were Averted by the Submarine Signal.

The United Fruit Company's steamer "Turrialba" went ashore off the New Jersey coast within a mile of a large gas buoy which could not be seen in the snowstorm. That ship had submarine signal receiving apparatus, but the Government had failed to equip the buoy with a bell. The "Uranium," wrecked near Halifax, passed within two and one half miles of the submarine bell at Chebucto Head. She was not equipped with receiving apparatus. The passengers, in both cases, had a narrow escape from drowning. The steamer "Rosecrans," mistaking in the fog the North Head Light for the Columbia River Lightship, was wrecked at Peacock Spit. The lightship was equipped with a bell, but the steamer was not equipped with receiving apparatus. Thirty-two people were drowned, and the survivors suffered untold hardships. These wrecks were all unnecessary. Had the Government in the one case and the steamship companies in the other performed their obvious duty, no wreck would have occurred.

Nowadays each submarine in the United States Navy carries both bell and receiving apparatus. In a test at Newport, when the submarine "Octopus" was running under water, a tug crossed its course, paying out towline, which lay directly in the path of the submarine. It was only a matter of moments before she would have been wrecked by the hawser, when her tender signaled her to come to the surface. She instantly obeyed, and escaped almost certain destruction. The French submarine "Pluviose," while maneuvering outside Calais Harbor, arose to the surface directly in front of a cross-channel steamer, and was sunk with all her crew of twenty-seven. Had she been equipped with a submarine signal, she would have heard the approaching steamer in time to avoid a collision.

In future, the sunken submarine equipped with an oscillator will send Morse code messages through the water which can be heard on board any craft within a radius of several miles, even if these neighboring craft are without receiving apparatus, for the sound made by the oscillator is so strong and penetrating that it will pass through the hull of any craft on the surface, and can be readily heard in the open air.

The Fessenden Oscillator Obtains an Echo from Iceberg.

After the "Titanic" disaster, as the result of the London Conference, the International Ice Observation and Ice Patrol Service was started, and the United States revenue cutters "Seneca" and "Miami" were detailed to relieve each other as patrol vessels in locating icebergs and field ice nearest to the transatlantic steamship lane. Prof. Fessenden and R. Fulton Blake, accompanied the "Miami" on her first cruise (April 15th to May 1st, 1914), and the following extract from the official report of her Captain, Commandant J. H. Quinan, illustrates just how the oscillator might have prevented the "Titanic" disaster:

"We stopped near a large berg, and by range-finder and sextant computed it to be 450 feet long and 130 feet high. Although we had gotten within 150 yards of the perpendicular face of this berg and obtained no echo from the steam whistle, Prof. Fessenden obtained satisfactory results with the submarine electric oscillator placed 10 feet below surface, getting distinct echoes from the berg at various distances, from one half mile to two and one half miles. These echoes were not only heard through the receivers of the oscillator in the wireless room, but were plainly heard by the officers in the wardroom and engine-room storeroom below the water-line. The distance of the ship, as shown by the echoes with stop-watch, corresponded with the distance of the ship as determined by range finder. . . . On the morning of April 27th, anchored in 37 fathoms of water, Prof. Fessenden took advantage of the smooth sea to further experiment with his oscillator in determining by echo the depth of water, the result giving 36 fathoms, which seemed to me very close. . . ."

An Aerodynamic Balance

AT the recent Conversazione of the Royal Society, an aerodynamic balance was exhibited, designed for the experimental investigation of the stability of aeroplanes. The main part of the balance consists of three arms mutually at right angles, each arm being counterbalanced. These arms meet in a point at which a steel center is fixed, and the weight of the balance is taken on this point. The vertical arm passes through the under side of a wind channel and supports the model under test. The horizontal arms are arranged respectively parallel and at right angles to the wind direction. The arrangements allow of the measurement of the forces on the model along three fixed rectangular axes, and also of the three moments about these axes for any angle of incidence of the wind on the model. The instrument is made to the designs of the staff of the National Physical Laboratory, and was exhibited by the courtesy of the directors of the Aeronautical Department of the Massachusetts Institute of Technology, for whom the instrument has been constructed.

The Current Supplement

IN this week's issue of our SUPPLEMENT, No. 2009, Sir William Willcocks of Cairo, Egypt, draws lessons from ancient Egyptian practice, which he embodies in a most interesting article, "How the Ancients Would Have Controlled the Mississippi."—F. D. Banham gives directions for building a novel yacht.—Alexander Siemens discusses the advantages of the metric system.—In an article on safety at sea, some of the signals which figured in the testimony at the inquest on the "Empress of Ireland" disaster are described and illustrated.—In an article on metallic colloids and their bactericidal properties Henry Crookes makes some interesting comparisons regarding the size of microbes and of colloid particles.—In a valuable paper, entitled "New Light on the Structure of Matter," Arthur H. Compton gives an account of recent researches, in which X-rays are used to disclose the arrangement of atoms and molecules in crystals.—Richard W. Allen writes on modern pumping machinery and for the drainage of the Fens, England.—Prof. Svante Arrhenius took for the subject of his recent Tyndall lectures "The Identity of Chemical and Biochemical Laws." A summary of his remarks appears in this issue.

A Danish North Polar Expedition will probably go north next summer, under the leadership of Knud Rasmussen, who is well known for his geographical and ethnographical explorations in Greenland, and for his remarkable journey across the northern extremity of the Greenland ice-cap in 1912. The party will establish its base at Cape York, Greenland, and will be provisioned for two years. The funds for this undertaking have been provided by Ole Olsen, a Danish millionaire.

The Manufacture and Fitting of Piston Rings

How the Efficiency of a Motorcar is Dependent Upon Gas-tight Ring-joints

By H. S. Whiting

IF the valves of the gasoline motor are the sentries placed on guard at the entrance to and exit from each cylinder to make certain that the mixture follows its proper course at the proper time, the piston rings are the walls or ramparts that confine the gases within their well-defined limits.

Piston rings have well been termed "power dams." If the dam leaks, so that a portion of the inflammable gases or the force of the expansion due to the explosion escapes, power will be wasted. The proper fit of the rings, therefore, becomes a matter of dollars and cents to the owner, for a loss of power means a waste of gasoline.

Inasmuch as the piston moves in the cylinder, the one cannot be a tight fit in the other. It is a difficult matter to obtain a freedom of motion and a gas-tight joint at the same time, and the high temperatures found in the cylinders of an internal combustion motor complicate matters somewhat. Allowance must be made for the unequal expansion of the uncooled piston head and the water-jacketed cylinder walls, and therefore a clearance of one or two thousandths of an inch must be allowed. Insignificant as this space may seem, it is nevertheless sufficient to allow the escape of nearly all of the mixture at each compression stroke, and therefore some means must be provided to form a gas-tight joint.

This is the function of the piston ring, and whether it—together with its two or three companions in each cylinder—performs its work ill or well depends upon many features of material, construction, application, and fitting. Evidently a more or less elastic packing must be used, to allow for the slight expansion and contraction of the cylinder walls, caused by the variations in temperatures. A fibrous material would possess neither the strength nor the heat-resisting qualities necessary to retain the powerful hot gases within their confines, and therefore metal rings are used exclusively. It might seem that a high-grade steel of the same kind as that of which springs are made would answer these requirements, but while such a material would possess the proper elasticity, its extreme hardness would soon wear the iron cylinder walls, regardless of the amount of lubrication that might be applied. It has therefore been determined that the same fine, gray, cast iron of which the cylinders are made forms the best all-around material for piston rings, although special alloys have been used, with varying degrees of success. It is the practice of some manufacturers who make a specialty of piston rings to employ a quality of gray iron somewhat softer than that from which the cylinders are cast, in order to make certain that whatever wear occurs will be on the easily-replaced rings rather than on the more expensive cylinder casting.

Not only must the piston rings be elastic, in order to conform to the size of the cylinder bore, and press tightly against the walls at all points, but they must be sufficiently flexible, so that they may be forced on over the piston when they are to be placed in their grooves. This means that the inside of each ring is expanded to the normal diameter of the outside, and it is under these conditions that a ring is most liable to break, due to the strain induced at a point directly opposite the joint. Consequently the greatest care must be taken when removing or applying a ring to make certain that it is not expanded beyond the size necessary to enable it to be slipped on over the piston.

Inasmuch as the ring must be flexible, so that it may contract or expand, it cannot be a continuous ring, or circle. This split, or joint, is really one of the most important parts of the piston ring, for upon its formation and fitting depend the gas-tight qualities. The simplest form of split is the straight, diagonal cut. But this is not as efficient as the joint formed by a rectangle cut from diagonally opposite corners of a straight slot, thus forming overlapping tongues. The adjoining vertical surfaces of this joint cannot always be in contact with each other, as it is the movement of these points that allows for the necessary contraction and expansion of the ring. The overlapping horizontal surfaces, however, can be finished to a comparatively tight fit.

As the greatest danger of leakage in a well-fitting piston ring lies at the joint, the three rings of a piston are generally so placed that alternate joints lie diametrically opposite each other. Thus, gas escaping beyond the joint of the first ring is prevented from passing directly by the piston, but must be deflected several times in order to reach all of the joints. In order to keep the respective rings in their proper positions, pins are oftentimes inserted in the grooves, to serve as a stop for the ends of the joint. But it is not often that all of the rings—even though unpinned—would work

(Concluded on page 17.)

1. Boring and turning a "pot casting." 2. Forming and cutting off the rings from the pot casting at one operation. 3. Splitting rings by cutting out a small segment. 4. Putting in the brass pin in a double ring, to keep the parts in relative position. *A, B, C,* and *D,* various types of gas-tight piston rings; *E,* how a gang of tools for cutting rings out of a pot are set to come successively into action.

The making of gas-tight piston rings.

The Heavens in July

Are Comets Visitors, or Do They Belong to the Solar Family?

By Henry Norris Russell, Ph.D.

AMONG the astronomical publications of the past month, one of the most interesting comes from Copenhagen, and deals with the much-discussed question of the origin of comets.

Ever since it was found that most comets move in nearly parabolic orbits, and must have come from a distance many times greater than that of the remotest planet of the solar system, it has been a question whether they really belong to our system at all, or are visitors from outer space. This is not an easy question to answer, and the definite assertion which Prof. Strömgren is now able to make, in the memoir just mentioned, has only been made possible by skilled mathematical analysis and laborious computations; but the principles on which his work has been done are simple enough to explain here.

All students of astronomy know that the orbit of a comet (or of any other body moving freely under the force of the Sun's gravitation) may be an ellipse, a parabola, or a hyperbola. In the first case, the orbit is a closed curve. If we could follow the comet's motion as it receded farther and farther from the Sun, we would find that the rate of its recession grew ever slower and slower, until at last the Sun's attraction prevailed, the comet began to move inward again, at first slowly, but with ever-increasing speed, returning at last to perihelion, and completing this cycle over and over again.

A hyperbolic orbit appears when the comet's velocity is so great that the Sun's attraction is not able to slow it down completely. As it recedes from the Sun, its velocity grows less and less, but always remains greater than a certain limit, so that, after the comet has got a long way from the Sun, its path will be practically a straight line, along which it moves at a definite speed out into interstellar space. Following it back, it is found that (if no forces other than the Sun's attraction had come into play) a comet must have been approaching our system from the outside with this same definite speed, before it was sensibly influenced by the Sun's attraction.

The parabolic orbit reaches the limiting case between the other two, in which the velocity is just too great for the Sun's attraction ever to overcome. A comet moving in an orbit of this kind would forever recede from the Sun, but at a rate continually diminishing, without limit, so that at very great distances its motion would be exceedingly slow.

The slightest retardation of the motion of such a comet would enable the Sun's attraction to gain the upper hand; the orbit would become an elongated ellipse, and the comet would return in due time to the Sun again and again. The slightest acceleration of the comet's motion would convert its orbit into a hyperbola, and send it off to infinity faster than in its original path.

Such effects may arise—indeed, they invariably must arise—from the attractions of the planets upon the comet and the Sun. Repeated slowings of its motion by such encounters may convert a comet's orbit into a relatively small ellipse, around which it goes in a comparatively short period. A slight quickening of its speed may suffice to send it out of our system for good and all.

A comet entering our system from interstellar space, and moving as fast when remote from the Sun as the stars do, would have an orbit of very marked hyperbolic character, which could not possibly be mistaken for a parabola. Not one of the hundreds of comets which have been observed has behaved in this way. Their orbits are sometimes ellipses of relatively short period; much more often they are so nearly parabolic that it takes long and careful observation and extensive calculation to detect any divergence from this form. When this work is done, the deviation is usually found to be in the direction of the ellipse; but in a few cases the orbits are distinctly hyperbolic—differing more from the parabola than any possible errors of observation could account for. Even in these cases, however, the divergence is so small that it would be quite imperceptible in a scale drawing the size of this page showing the part of the comet's orbit which it traversed while under observation. It would seem then, at first sight, that the comets cannot be visitors from outer space, since none of them have orbits of the kind that might then be expected. But Schiaparelli, in 1910, showed that this reasoning was insufficient. A comet visiting us from without would usually pass away, never to return. But if it came near a planet, and its motion was sufficiently retarded, its orbit would become an ellipse, and it would return thereafter again and again, and be counted every time, if our observations were thorough enough and sufficiently long continued. This would be true of every similar "captured" comet; and hence, objects of this sort which, though now members of our system, were not originally so, might form the large majority of the comets actually observed.

If then it can be shown that *any* of the known comets have entered our system from outside, it is possible that *all* of them may have originally done so, some being detained in it, as just described. It is, therefore, very important to know whether the comets, whose orbits when we observed them, near the Sun, were hyperbolic, were moving in hyperbolic orbits as they approached our system, or whether the present character of their orbits has arisen from speeding up of their motion by planetary perturbation.

This is the question which Prof. Strömgren has investigated. Choosing the comets for which the evidence for a hyperbolic orbit was most conclusive, and calculating backward for years, he finds that in every case the hyperbolic character of the observed orbit was actually due to planetary influences. When approaching the Sun, and still remote from it, four of the eight comets investigated were moving in definitely elliptical orbits. In the case of the other four, the original orbit was so nearly parabolic that even the numerous and accurate observations which were obtained did not suffice to show in which direction it differed from a parabola.

In every case the observations are consistent with the belief that the orbit was elliptic; that is, that the comet was returning after a previous visit to the Sun, and was not a visitor from outer space. And in most cases there can be no doubt that this was the fact.

It appears, therefore, to be practically certain that all the known comets have originated within our own system. They belong to the Sun's family, and are not visitors from the stars.

They must be by far the most numerous of the Sun's family, too. Of the eight comets studied by Strömgren, six must have taken at least a million years apiece to complete the round of their orbits preceding the last return, and receded from the Sun while on their way to at least 20,000 times the Earth's distance, or 1/14th of the distance of the nearest star. All these comets appeared within twenty years (from 1882 to 1902). If as many comets of this sort come every twenty years, at least 300,000 of them must come to perihelion before the first ones return—and this takes no account of those which came back, but escaped our notice, during the twenty years aforesaid. The whole number of comets must then be counted by millions, at least.

Of the comets recently or still under observation, Kritzinger's and Zlatinsky's are receding from the Sun and growing fainter. The latter, conspicuous at the time of discovery, will be some thirty times fainter on July 1st than it was then, and not easily visible in a small telescope. Its position on July 3rd will be in right ascension 9 hours 37 minutes, declination 15 degrees south, and it will be moving southeastward about 1 degree per day.

Delavan's comet, on the other hand, is coming out into the morning sky, and rapidly growing brighter. On July 4th it is in 4 hours 57 minutes right ascension + 30 degrees 22 minutes declination, and on the 28th in 5 hours 53 minutes + 37 degrees 39 minutes, close to θ Aurigae. By this time it is well observable in the morning sky, rising about 1 A. M., and at a good altitude before dawn. It doubles in brightness during the month, but will increase still more in August.

Its orbit must be very nearly parabolic, so nearly so that it will take long calculations to determine its period, if it turns out to be periodic at all.

At 11 o'clock: July 7.
At 10½ o'clock: July 14.
At 10 o'clock: July 22.

At 9 o'clock: Aug. 7.
At 8½ o'clock: Aug. 14.
At 8 o'clock: Aug. 22.

At 9½ o'clock: July 30.

NIGHT SKY: JULY AND AUGUST

The Heavens.

The familiar constellations of summer need little more in the way of description than our map affords. The finest region of the Milky Way—full of bright patches, and abounding in star-clusters and nebulæ—is displayed at its best in the southern sky. Scorpio and Sagittarius, both fine constellations, add to its splendor.

Aquila, Cygnus, and Lyra form a fine group high up in the east and overhead. Hercules and Ophiuchus occupy the southwestern sky, and Bootes is lower, in the west. Above Virgo, which is setting, Ursa Major, Ursa Minor, and Draco are in the north and northwest, and Cassiopeia in the northeast. The great square of Pegasus has just risen, and the dull constellations Aquarius and Capricornus are in the southeast.

The Planets.

Mercury is an evening star at the beginning of the month, but is south of the Sun, and not easy to see, as he sets at 8:30 P. M. He rapidly approaches the Sun, and passes south of him on the 16th, becoming a morning star. At the end of July he rises at 3:40 A. M., and may be seen in the dawn. Venus is conspicuous as an evening star, setting at 9:35 on the 1st and 9 on the 31st. Mars is evening star, too, in Leo, setting at 9:50 on the 15th. Jupiter is in the eastern part of Capricornus, rising at 9:50 on the 1st, and 7:45 on the 31st. He is still pretty far south, but not so much so as for the past three years.

Saturn is a morning star in Taurus, and rises a little before 3 A. M. in the middle of the month.

Uranus is in Capricornus, and is approaching opposition. He crosses the meridian at 1 A. M. on the 20th and is observable much earlier; but he is not near any conspicuous star, and is hard to find. With a star map, he may be picked up, his position being 20 hours, 54 minutes, 5 seconds, — 18 degrees 9 minutes on June 30th, and 20 hours, 49 minutes, 58 seconds, — 18 degrees 26 minutes on July 29th. He is just visible to the naked eye on a clear, dark night, as a star of magnitude 6.0, but is better seen with a field glass.

Neptune is in conjunction with the Sun on the 21st, and is quite invisible.

The Moon is full at 9 A. M. on the 7th, in her last quarter at 3 A. M. on the 15th, new at 10 P. M. on the 22nd, and in her first quarter at 7 P. M. on the 29th. She is nearest the Earth on the 3rd and the 28th, and remotest on the 15th. As this last date is very near that of the last quarter, the tides on that day will show an exceptionally small range.

The Moon is in conjunction with Uranus on the 9th, Jupiter on the 10th, Saturn on the 20th, Mercury and Neptune on the 22nd, and with Venus and Mars on the 25th, when the three bodies will form a pretty spectacle.

Princeton University Observatory.

First Ocean-going Vessel Passes Through Panama Canal

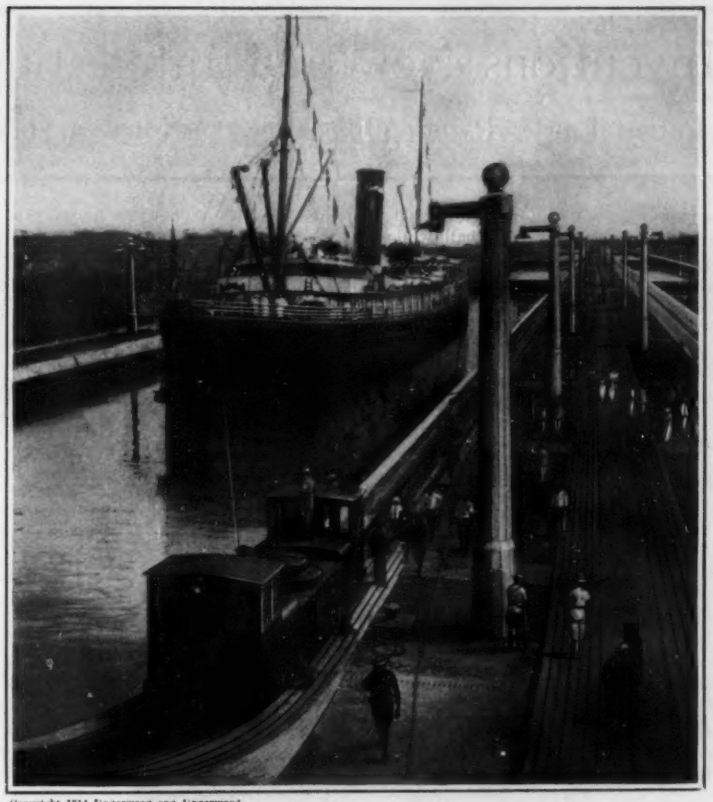
THE first passage of the Panama Canal by an ocean-going ship was marked by the recent transit of the "Alliance," a vessel belonging to the Panama Railroad Company. This ship is 336 feet long, 42 feet in beam, and draws about 23.9 feet of water. Her tonnage is 3,905 tons; and when she passed through the canal she had on board 1,800 tons of cargo. The ship was sent through by order of Col. Goethals, for the purpose of making a test with a ship of ocean-going size.

The "Alliance" is shown in our photograph under tow in Gatun locks by the electrical-towing locomotives, one of which is clearly shown in the foreground of the illustration. This locomotive is about to climb the steep incline, 28 1/3 feet in height, by which the tracks rise from one level to the next.

This first transit of the locks by a ship of size occurred on June 8th, and we enter below the full log of the "Alliance" covering the passage from ocean to ocean.

LOG OF THE PASSAGE OF THE PANAMA CANAL BY THE "ALLIANCE."

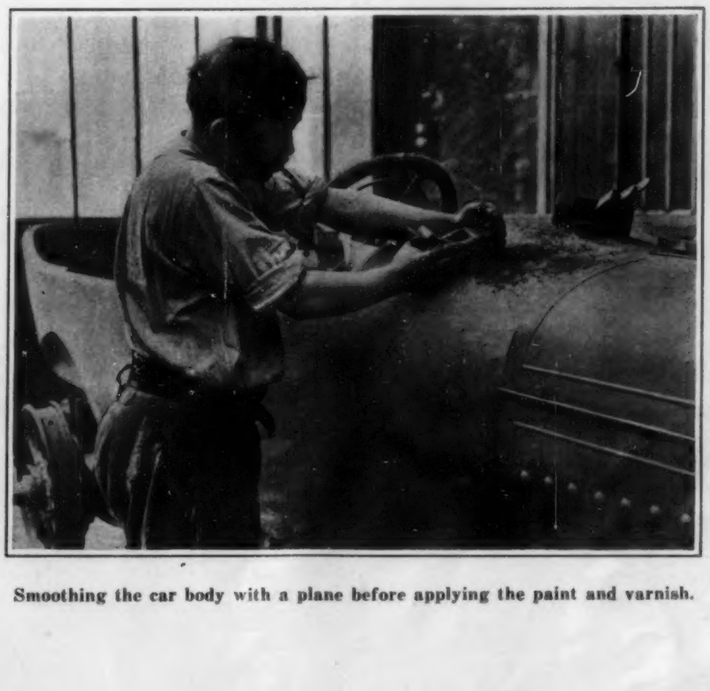
A. M.	
6:03	Entered Atlantic approach to canal.
6:35	Entered lower level of Gatun locks.
7:18	Started into lower lock chamber.
7:28	Ship in place in lower lock chamber.
7:30	Gates of lower lock chamber closed.
7:32	Started to fill lower lock chamber.
7:43	Lower lock chamber filled.
7:45	Gates to middle lock opened.
7:47	Ship started into middle lock chamber.
7:55	Ship in place in middle lock chamber.
7:57	Gates to middle lock chamber closed.
8:00	Started to fill upper lock chamber.
8:11	Upper lock chamber full.
8:12	Gates to upper lock chamber opened.
8:23	Ship in place in upper lock chamber.
8:25	Gates to upper lock chamber closed.
8:39	Upper lock chamber full and gates to Gatun Lake opened.
8:42	Ship towed out of upper lock chamber.
8:48	Ship cast off by towing engines and proceeded under own steam.



The "Alliance" passing through Gatun locks.

This steamer, of 3,905 tons, was the first ocean-going ship to pass through the Panama Canal.

The modeler applying the plaster to the wire netting.



Smoothing the car body with a plane before applying the paint and varnish.

Making Motorcar Bodies With a Trowel

IN a recent article on automobile manufacture we called attention to the variety of trades that contribute to the construction of a modern motorcar. A new class of artisan has just been added to the list. A French firm of car manufacturers makes its car bodies by a novel process of plastering, or may be we should say modeling; for it requires more skill than that of the common plasterer.

Builders are familiar with the process of making partition walls by erecting a screen of wire netting and coating it with a layer of plaster. Practically the same thing is done in the new process of making car bodies, except that a very different plaster is used. The framework of the car is made of wood, and on this wire netting is tacked, as shown in our cover illustration. Then the modeler begins operations with palette and trowel, daubing the wire netting with the plastic material, which he spreads out smoothly. After the coating has set, it may be dressed down with a plane and sandpaper, just like wood. After that it is painted and rubbed down with oils and varnish until it assumes a very high polish.

It is claimed for the new process, that the car bodies can be manufactured with a great saving of time, and also, that a very light and durable body is obtained.

Mount Lassen an Active Volcano in California

THE ancient and long dormant volcano known as Lassen Peak, in Shasta County, northern California, burst into eruption on the afternoon of May 30th, since which time several renewals of activity have occurred. This mountain is the culminating summit in a belt of volcanic cones, appearing from the maps to be a part of the Sierra Nevada, but belonging geologically to the Cascade Range. Its altitude is 10,437 feet, and it bears large patches of perennial snow. Ten miles northeast of Lassen Peak lies the summit known as the Cinder Cone, which is supposed to have been active as late as the middle of the nineteenth century, though its principal eruption must have occurred at least 200 years ago. Although vast lava sheets and lofty volcanic mountains abound in northern California, Oregon, and Washington, very few eruptions have occurred in this region since the advent of the white man; in fact, such as are supposed to have occurred in historic times belong to the earliest period of settlement, and their dates have been a subject of much controversy. Mount Hood and Mount Rainier still exhale vapor; Mount St. Helens was in eruption in 1841 and 1842; while Mount Baker, the most northerly volcano of the Cascade Range, is said to have been active in 1843. The eruptions above mentioned are the latest that have occurred anywhere in the continental United States (exclusive of Alaska). Hence the interest which attaches to the present outbreak in California.

However, in a comparatively recent period, geologically speaking, the Lassen Peak region was the scene of volcanic eruptions on a tremendous scale. The immediate surroundings of the peak constitute a volcanic ridge about 25 miles in width and 50 miles in length, built up of lava from about 120 vents. Some of the craters are over a mile in diameter. Lassen Peak is connected by lava with Mount Shasta, and, in fact, belongs to a lava-covered area about 200,000 square miles in extent—perhaps the largest volcanic field in the world—extending eastward from the Cascade Range.

The principal geological investigations in the neighborhod of Lassen Peak were those made nearly a quarter of a century ago by Mr. J. S. Diller, who has just been sent by the U. S. Geological Survey to study the recent eruption. Writing in 1894, Mr. Diller said: "That volcanic activity is not yet extinct in the Lassen Peak district is shown by the presence of numerous solfataras and hot springs. At Bumpass's Hell, near the southern base of the peak, there are boiling mud pools and vigorous solfataric action. Near-by, at the head of Mill Creek, the sulphur deposited by such action is so abundant that attempts have been made to mine it. Similar phenomena occur in Hot Spring Valley and at Lake Tartarus and the geyser near Willow Lake. The geyser is much less vigorous than formerly, and now the column of water rises scarcely a foot above its pool."

The first outbreak in the recent eruption opened a new crater on the north flank of the peak, and showered the whole mountain with rock and ashes. A forest ranger who ascended the mountain, May 31st, reported the crater to be 30 feet wide by 50 feet long, with many fissures in the mountain side. No lava was seen. A more violent outbreak occurred on June 9th, and appears to have enlarged the crater to many times its original size. On the 14th and 15th five more outbreaks occurred. One of these is described as having sent a column of black smoke, steam, and ashes to a height of 2,000 feet above the summit. The eruption was conspicuously visible at a distance of 50 miles.

The region surrounding the peak is very sparsely settled, so that very little damage to property has been caused by the eruption, but one man who imprudently attempted to ascend the mountain during the outbreak was mortally injured by a falling rock, and several other persons had narrow escapes.

Decision of Commissioner Ewing.—In the case of Manson v. Hutchison, Commissioner Ewing has overruled the case of Baltzley v. Seeberger and holds that a patentee should not be permitted to bring a motion to dissolve an interference in which he is involved on the ground that it is not patentable, since otherwise the patentee could contend in the Patent Office that the subject matter of the patent is not patentable and in the courts that his patent is valid.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Self-inflating Pneumatic Life-preserver

A LIFE-PRESERVER in "vest-pocket" edition has recently appeared on the market. It weighs but 15 ounces, and is carried in a case measuring less than six inches cubed, that looks like a small hand camera. The life-preserver or belt consists of a bag of waterproof canvas, curved to take the form of a ring when extended, and fitted with hollow aluminium ribs. The ribs give the bag the form of a horseshoe, in section; that is, the outer periphery is curved, while the inner one is flat, so that it will have a good bearing on the body of the wearer.

The belt is provided with straps at each end, for tying it at both its inner and its outer peripheries.

In applying the life-preserver, inflation is effected automatically by extending the belt, when the air rushes in through a valve. The belt is placed about the body, and first the inner straps are pulled taut and tied, after which the belt is completely distended and inflated by drawing up the outer straps and tying them fast. This done, the valve is closed, and the life-preserver is ready for use. Its buoyancy is sufficient to hold a man head and shoulders out of the water. In fact, it will sustain a number of persons. To fold the belt, the valve must first be opened to let the air out. One of our illustrations shows how compactly the belt may be folded.

The "Air Towel"

AGITATION for the suppression of the roller or common towel for public use has swept over the entire country, as it is considered a menace to public health. Shortly after the elimination of the public drinking cup by all authorities, the crusade on the common towel in public places started, and some ten months ago Massachusetts, Ohio, and Michigan passed laws prohibiting its use; since then more than thirty States have made similar laws.

The common towel was succeeded by the paper towel, the use of which requires, besides the initial expense of the towels, an attendant to supply fresh and remove soiled and wet towels from the lavatories; now the last word in economical and sanitary innovations is the "air towel" used in the large public lavatory in the District Building at Washington, D. C. This "air towel," or electric hand drier, is the invention of J. M. Ward, superintendent of the District Building. In appearance it resembles a rectangular box 11 by 13 inches set on a sanitary base having 12-inch legs, with an opening in the top of the case in which the wet hands are held while being dried. The device consists of a blower that forces air through an electric heating element to ducts and deflectors suitably placed for distributing the warmed air to all parts of the hands at the same time, and is operated by a foot lever or pedal, which in turn operates a quick-acting switch, thereby setting the blower in motion; by removing the foot the device is put out of operation; the hands come in contact with no part of the device, thus assuring a perfectly sanitary operation.

It takes just 30 seconds to dry the hands, and although this seems long while standing with the hands in the drier and practically unoccupied, tests have shown that the ordinary operation of drying the hands with a towel consumes more time if the hands are to be dried as thoroughly as by the electrical drier. Being dried perfectly, there is no unpleasant sensation.

Sun Glasses for Ball Players

THE latest in baseball is the invention of sun glasses for fielders. The glasses are riveted to the peak of the cap and work on a hinge. When not needed to shield the eyes, the glasses rest against the peak of the cap. When a ball is hit, the fielder wearing a pair of these new glasses simply touches the rim of the glasses, and they fall down in front of his eyes and give him a chance to see the approaching ball while looking directly into the sun. There is no chance for them to fall off the cap, and the fielder does not have to look through dark glasses all the time. They are the invention of Fred Clarke, manager of the Pittsburgh National League team.

The lifebelt folded and ready to be packed in its case.

How the lifebelt is worn.

Making the Punch Press Safe

THE punch press has always been a constant source of danger to hands and fingers of the men operating them. Through the invention of the suction lift, all necessity for the operator of a machine to place his hands in the danger zone has been eliminated. The safety device comprises merely a rubber disk attached to a hollow handle which is connected by a hose to a suction line, causing the rubber at the end to act as a "sucker." The device shown is adapted for hand operation only. There is another design that is connected to the back of the machine, and which is free to move back and forth upon an irregularly-shaped rod. Just how far it may move is controlled by the operator on the other side of the press. Here are found two guide arms, one on each side of the press. The workman pushes these arms through under the press and toward the pile of material which he wishes to feed through. As the sucker comes into contact with the first strip of material a lever is pressed by the operator, which opens a suction valve, and the lifter grasps the material and pulls it through.

Notes for Inventors

Specialized Invention.—Inventions designed for use in connection with devices or apparatus which have gone largely into general use frequently yield a large reward. The magazines now contain advertisements of appliances especially designed for use on certain well-known machines and restricted as to use on such machines. Consider, for instance, the field that would open to a device that would noticeably increase the efficiency or add to the desirability or comfort of a cheap automobile or safety razor. The market has already been created, and the possessors of the machine or device would have to be convinced only of the merit of the attachment. The improvement should be capable of easy application by the purchaser, and its importance and practicability should be easy of demonstration.

Milk Bottle Tops.—The ideal milk bottle top has probably not yet been invented. The bottle in general use has within the neck a groove in which seats the edge of a card-board disk forced down into place; frequently there is no means to aid in its removal. The groove forms a receptacle for dirt and germs, and the interior of the neck above the groove is a catch-all for dust and other undesirables. If the closure were to fit over instead of in the neck, the groove could be dispensed with, the capacity of the bottle increased, and the entire interior of the bottle neck protected. The problem seems to be in securing a cap cover instead of a disk in the neck. Who can suggest or develop a simple, economical, and practical closure? Wouldn't the consumers be willing to pay for the extra service, or shouldn't the increased business resulting from a better service warrant the additional expenditure on the part of the milkman?

Summer Activities in the Patent Office.—For several years past it has been the custom in the Patent Office to docket few, if any, appeal cases for hearing by the Commissioner of Patents or the Assistant Commissioners during July and August. This year, however, the docketing of cases has continued without regard to the summer months, but doubtless no great difficulty will be experienced in having cases set for hearing during the heated term, postponed on request. In this way the Office will not delay business which ought to be expedited, and the wishes of counsel relatively to summer vacations will have due consideration.

A High-power Explosive.—R. E. Mansfield, Consul General at Vancouver, Canada, tells of tests recently made before business men of Vancouver, of an explosive called "Sabulite," which it is proposed to manufacture at Coquitlam, British Columbia. It is claimed that while the explosive, used for blasting purposes, only requires about one third as much as dynamite, that it can be handled both while in the course of manufacture and in use without danger, that none of its ingredients in themselves are explosive, and that the product is not affected by heat or cold.

Oil Heater for Heating Water.—The General Gas Appliance Company of New York city, as assignee of Charles D. Elmer of Passaic, N. J., has secured a patent 1,098,373, for a water heater in which a number of oil burners, each having an individual chimney, are utilized.

Sun glasses for ball players.

Drying the hands with air.

Suction lifter for punch presses.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

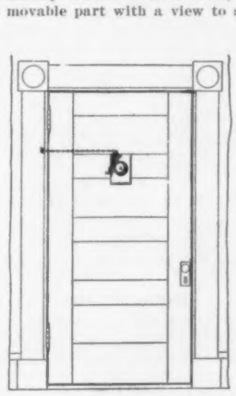
Pertaining to Apparel.

COLLAR FASTENER AND SUPPORT.—MARY H. JAYNE, 172 Manhattan St., New York. The object of this invention is to provide a stiffening support for the standing collars of ladies' garments formed with hooked members or pieces designed to engage the opposite sides of the collar, and thus hold their adjacent ends together and have the collar properly supported.

BELTING AND PROCESS FOR MAKING THE SAME.—R. PARKER, care of Parker Stearns & Co., 300 Sheffield Ave., Brooklyn, N. Y. The invention relates particularly to an inner belt to be worn by women for the purpose of holding down the shirtwaist and supporting the skirt. The belting has its opposite faces covered with rubber, which in the process of making the belting is given a roughened surface so as to provide a tenacious grip on the shirtwaist and skirt.

Electrical Devices.

PORTABLE BURGLAR ALARM.—S. SUNDEL, 103 E. 125th St., New York. A burglar alarm is provided by this invention for the use of travelers and other persons. It may be conveniently attached to a door, window or other movable part with a view to sounding an alarm on the movement of that part. A flexible connection runs from an electric contact device to a fixed part such as a door frame, so that when the door is opened, the contact is closed and the alarm is sounded.



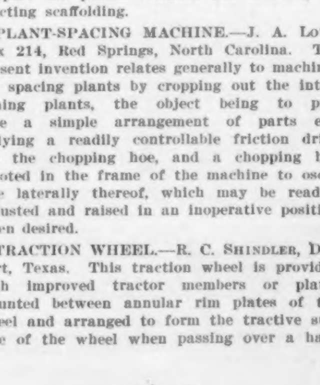
PORTABLE BURGLAR ALARM FOR TRAVELERS.

Of Interest to Farmers.

SILO.—C. HUNGERFORD, Soldier, Kan. As the usual hoop and stave construction of silos is liable to distortion under strains of swelling and shrinking, the present invention provides a construction embodying a novel arrangement of uprights and horizontal beams, whereby the necessary strength will be given the structure as it progresses, and the element entering into the construction will be so disposed as to provide a convenient and effective support for planks without the necessity of erecting scaffolding.

PLANT-SPACING MACHINE.—J. A. LOVE, Box 214, Red Springs, North Carolina. The present invention relates generally to machines for spacing plants by cropping out the intervening plants, the object being to provide a simple arrangement of parts embodying a readily controllable friction drive for the chopping hoe, and a chopping hoe pivoted in the frame of the machine to oscillate laterally thereof, which may be readily adjusted and raised in an inoperative position when desired.

TRACTION WHEEL.—R. C. SHINDLER, Dalhart, Texas. This traction wheel is provided with improved tractor members or plates mounted between annular rim plates of the wheel and arranged to form the tractive surface of the wheel when passing over a hard traction surface, the plates automatically projecting at one end when the wheel passes over a soft traction surface in order to effect satisfactory grip and prevent the wheel from slipping.



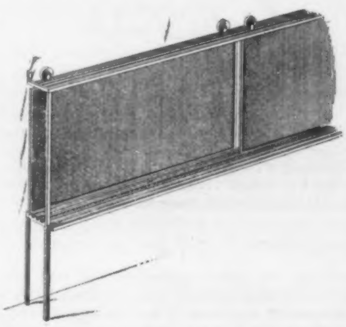
TRACTION WHEEL THAT WILL NOT SLIP ON SOFT GROUND.

COMBINED SEED PLANTER AND FERTILIZER DISTRIBUTOR.—T. C. WILSON, care of Holman & Holman, Fayetteville, Tenn. This device may be readily attached to a plow of any standard construction, and will uniformly distribute the fertilizer on the plowed ground, automatically feed the seed into a progressively formed seed furrow and cover the seed so deposited. Thus all the work of planting and fertilizing is done in the one operation of plowing the ground.

Of General Interest.

PLASTER COMPOSITION.—J. E. FAIRFAX, Aiken, South Carolina. This plaster composition is waterproof and can be used on wood as well as metal laths. It comprises ingredients substantially in proportion as follows: Plaster of Paris, 25 per cent; slaked lime, 25 per cent; kaolin, 5 per cent; sand, 44.65 per cent; fibered hay, 3 per cent; Rochelle salt, .05 per cent.

BLACKBOARD.—EMILY K. HOPKINS, 609 E. Chestnut St., Louisville, Ky. This blackboard is provided with movable sections designed to be nested one in front of the other whenever desired. The framework of the blackboard is provided with a lower guiding portion and a number of upper rails, each adapted to receive rollers, which hold suspended, various blackboard sections. By this means any of the sections may be moved back and forth along the rails.



BLACKBOARD WITH MOVABLE SECTIONS.

BELT LOOP.—H. F. NILES, 1257 N. Clark St., Chicago, Ill. The present invention relates to belt loops used in garment supporters of the type shown in patent, No. 1,039,995, previously granted to Mr. Niles. The object of the present invention is to reduce the cost of the manufacture of loops of this character and to construct a loop from material of light weight, to avoid bulkiness in appearance.

BED JOINT.—A. POLANSKY, 653 Boulevard, Bayonne, N. J. One member of the joint consists of a metal band secured to the bed post and arranged to form a tapered socket. The other member of the joint consists of a plate adapted to fit into this socket, and connected to a bed rail with a spacing member interposed.

SPOOL MAGAZINE.—E. PRINCE, 747 Madison Ave., New York. A simple form of magazine is here provided for spools which may be easily and quickly secured to any suitable place such as a work table and wherein spools can be admitted or removed independently, and the color of the thread on the spools can be seen at a glance. By the use of this device, the tangling of the thread on the spools is avoided.

SEWING OUTFIT.—L. KALINA, 132 Nassau St., New York. In order to furnish a compact sewing outfit for pocket use, this invention provides a shell, which is closed at one end by a thimble, and at the other by a pin cushion, while within the shell are a needle case and a series of spools of sewing thread.

Hardware and Tools.

NUT LOCK.—J. J. GILCHRIST, 122 Anderson Street, N. S., Pittsburgh, Pa. The device consists of a washer having a resilient member to engage the side of a nut, and a locking plate with a bolt hole, a side flange to engage a side of the nut, and a resilient forked flange at an acute angle to the plate at the under side thereof, to straddle the bolt, the fork presenting two inner edges to engage a bolt thread, there being co-acting locking elements on the washer and lock plates to engage each other.

Heating and Lighting.

FURNACE.—F. H. WRIGHT, 114 E. 4th St., Chattanooga, Tenn. The invention relates to furnaces for general use and more especially to coal burning furnaces in which the grate bars are apt to become very hot, and in which as a consequence it is desirable to cool the grate bars by passing air through them, and causing the air thus heated to assist the combustion of the fuel. The invention also provides means for handling the fuel during its passage through the furnace, and distributing the air supply into and through the fuel.

Household Appliances.

WASHTUB.—A. L. BLUM, 170 W. 73rd St., New York. Among the principal objects which the present invention has in view are to provide a tub with a rubbing section or board portion formed integrally therein; to provide a relatively light and strong rubbing section; and to simplify and reduce the cost of construction.

Machines and Mechanical Devices.

MULTIPLE SIGNATURE MACHINE.—W. F. WILLIAMS, P. O. Box 100, Miami, Arizona. Among the objects of this invention is to provide a multiple signature machine characterized by the ease of manipulation and reliability of operation, due to the simplicity of construction and lightness of all movable joints. Another object is to provide means whereby additional pens may be utilized, or the number of pens reduced, with the minimum amount of trouble or loss of time, thereby adapting the machine for a wide range of uses.

WATER LIFTING DEVICE.—L. G. ROSE, P. O. Lock Box 166, Parma, Idaho. An improvement in water-lifting devices is here provided, consisting of a simple, inexpensive, and portable device especially adapted for use in irrigating ditches, for lifting the water from the ditch to the ground to be irrigated, when the ground is at a higher level than the ditch. The device may easily be transported from place to place, and in its construction, valves of all characters are dispensed with.

ATTACHMENT FOR CONVEYERS FOR BOTTLED SODA WATER.—E. R. BARBER, Valdosta, Lowndes County, Georgia. The present application is a division of an application filed previously by Mr. Barber, and relates particularly to a deflector attachment arranged in connection with a table forming part of the apparatus. The table has such capacity that any temporary suspension in the work of the attendants removing the bottles from the table while the conveyer continues to operate and deliver bottles, will simply serve to collect the bottles on the table, first at the outside, then gradually adding to the collected bottles until the table is filled.

JACK-SPOOL AND FASTENER.—H. O. TAFT, care Vermont Spool and Bobbin Co., Burlington, Vermont. This invention has for its object to provide an improved structure in jack-spools and fasteners that will not become loose, so that the head and gudgeon cannot grind against the cylinder. Another object of the invention is to provide a gudgeon and a lock for preventing the rotation thereof, whereby the head is held rigidly connected with the cylinder of the spool and none of the parts is allowed independent movement.

Medical Appliances.

FOUNTAIN SYRINGE ATTACHMENT.—H. F. ONG, 304 Oregonian Bldg., Portland, Oregon. The invention consists of a nozzle comprising a hollow oval globular member having a smooth inner end and an outer end comprising a valve piece, these ends having openings in alignment with each other. The device is also provided with an inlet neck on one side not far removed from the outside opening.

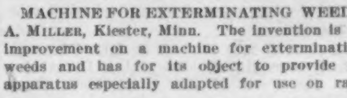
Prime Movers and Their Accessories.

BOILER ATTACHMENT.—J. S. DEVLIN, 141 N. Seventh St., Brooklyn, N. Y. This attachment for water-tube boilers is arranged to retard the travel of the smoke and gases from the boiler into the draft flue, to insure complete combustion of the burning fuel without interfering with the natural gas of the boiler. In order to do this, use is made of a casing arranged within the combustion chamber of the boiler at the entrance of the draft flue, a skeleton support held in the casing and carrying a set of bell-shaped retarding members and a grid movable toward and from the said retarding members and having openings in register with them.

CARBURETER.—F. L. TATOM, Hosford, Florida. The carbureter consists of a dome forming a spray chamber, which is mounted upon a float chamber. Leading up from the gasoline in the float chamber is a group of tubes, communicating at their lower ends with a hollow head, while their upper ends lie adjacent to the upper ends of a series of tubes through which compressed air is forced. These spraying devices being entirely inclosed within the structure of the carbureter are not liable to become clogged through the formation of ice due to the presence of moisture in the air.

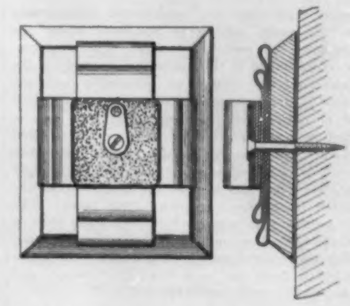
Railways and Their Accessories.

MACHINE FOR EXTERMINATING WEEDS.—A. MILLER, Kiester, Minn. The invention is an improvement on a machine for exterminating weeds and has for its object to provide an apparatus especially adapted for use on railroads. It is so arranged that it may propel itself along the railroad, and is fitted with mechanism which during its motion will uproot and remove the weeds growing between the rails.



MACHINE FOR EXTERMINATING WEEDS.

ARTICLE HOLDER.—W. M. GLOTFELTY, Ohiopyle, Pa. This article holder is especially adapted for use in railway cars, for holding small articles such as tickets, hats, caps, and the like within easy reach of the traveler. It consists of a block upon which are mounted two springs, each bent and folded to form superposed loops, so that articles may be clasped between these loops. The two springs are arranged at right angles to each other, as shown in the illustration.

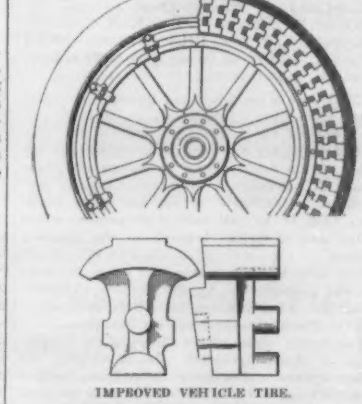


ARTICLE HOLDER FOR RAILWAY CARS.

Vehicles and Their Accessories.

HYDRAULIC POWER TRANSMISSION SYSTEM FOR WHEELED VEHICLES.—B. S. WILLIAMS, 17 Arcade, care Ben S. Williams Safe and Lock Co., Nashville, Tenn. The object of this invention is to enable the operator to use a number of separate driving units or pumps connected with driven units, and by throwing the driving units into action one at a time, to carry the pressure and volume of the liquid as admitted to the driven unit. Another object is to enable the operator to reverse the direction and travel of the liquid, the reversal taking place in all the units which happen to be in action at the time; to eliminate the necessity for differential gears, transmission gears, etc., and to improve various parts in connection with systems of this kind.

VEHICLE TIRE.—CHRISTIAN SPECHT, 417 Ocean View Ave., Woodhaven, L. I., N. Y. This invention relates to vehicle tires, and has for its object certain new and novel features adapted to produce a resilient tire, which is not liable to become worthless from punctures or other injuries, and comprises the usual outer tire, or shoe, inclosing interlocking blocks of rubber or similar material, the shoe being clamped in place by rings secured to the rim of the wheel.



IMPROVED VEHICLE TIRE.

Designs.

DESIGN FOR A CROCHET-COTTON HOLDER.—W. W. MCCHESNEY, care of V. Sales Company, 12 Spruce St., New York.

DESIGN FOR A CARPET OR RUG.—J. T. PEGEL, care of G. S. Squire, 25 Madison Ave., New York.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE YACHTSMAN'S ANNUAL GUIDE AND NAUTICAL CALENDAR. Thirty-sixth year. Boston: Clarence B. Hogg, 1914. 8vo.; 394 pp. Price, $1.

Some years ago we commented unfavorably upon this book, and gave instances where the information was wofully obsolete. There is, however, no criticism of this nature to be made of the present volume. This is an admirable guide for the use of the yachtsman, and is also a valuable fund of information to those who take only a fireside or book interest in yachting. It is filled with most valuable information, tables, maps and charts. It is sure to be well received, especially at a time when the eyes of the whole world are centered upon the "America" Cup races. The same publisher is bringing out, in a short time, a separate Cup Race publication which will contain among other useful matter some valuable information taken from the SCIENTIFIC AMERICAN, and published by special arrangement.

THE LAW OF PATENTS. By Walter F. Rogers, of the District of Columbia and New York Bars. In Two Volumes. The Bobbs-Merrill Company, 1914. 1859 pp. Price, $15 net.

In the two volumes constituting this work, the author has, it seems to us, placed at the disposal of those interested in patents a very able statement of the history of the legislation on the subject and of the rights and liabilities arising from the grant of patents. The rights of the inventor, and the applicant for the grant of a patent before the grant; the practice in interference proceedings in the Patent Office, and in appeals is clearly set forth so that the layman as well as the lawyer can understand it and be interested, and though brief, the matters seem to have been thoroughly covered. The work for the most part consists of extracts from decided cases illustrating points of practice in the courts pertinent to such questions as jurisdiction, pleading, suits at law and in equity, etc., also invention and infringement, and a very able analysis of the New Equity Rules, all of which should prove of inestimable value to the busy lawyer. The cases which have been selected by the author are leading cases, and the full and free abstracts provided are clearly explanatory of the science of the law as relating to patents.

PHYSIKALISCHE CHEMIE DER HOMOGENEN UND HETEROGENEN GASREAKTIONEN, MIT BESONDERER RUCKSICHT DER STRAHLUNGS UND QUANTENLEHRE SOWIE DES NERNSTSCHEN THEOREMS. (Physical Chemistry of Homogeneous and Heterogeneous Gas Reactions, with Special Regard to the Theory of Radiation and of Energy-Quanta, and the Nernst Theorem.) By Karl Jellinek. Leipzig: S. Hirzel, 1913. 844 pp. 10 x 7 inches. Price, in paper cover, 30 marks; bound, 32.5.0 marks.

If evidence is needed of the immense advances which have been made of recent years in our knowledge of the phenomena lying at the very root of chemistry and physics, a glance over the pages of the book before us brings abundant proof. It represents a very comprehensive presentation in text-book, or perhaps rather hand-book, form of the vast field of phenomena which to-day are of prime interest to the physical chemist.

The book is divided into four main divisions devoted respectively to the Statics (Thermodynamics), the Kinetics, the Electro-chemistry and the Photo-chemistry of Gas Reactions.

The author begins with a survey of the foundations of thermodynamics. In developing the second law, he makes use of the common method of considering a cycle carried out with an ideal perfect gas. It seems to the reviewer that this method is unfortunate, for on the one hand it bases the argument on a substance which does not exist, and on the other it is apt to leave in the student's mind the impression that there is some particular virtue in the use of an ideal gas—just the opposite of the impression that should be emphasized, namely, that the nature of the working substance is *quite* immaterial.

The author then proceeds to discuss the statics of gas reactions, first, on the basis of reversible cycles, and then by the aid of the several characteristic thermodynamic functions, entropy, free energy and thermodynamic potential. In this part of the book we also find the first introduction of the Nernst theorem, considered first from the standpoint of thermodynamics, and then from that of statistical mechanics.

The fourth section of the book is devoted to the modern theory of radiation, and introduces Planck's formula, derived from the theory of electrical oscillators.

The fifth section deals with the connection between the theory of heat radiation and the theory of specific heats, of heat of reaction and the Nernst theorem.

The remainder of the first division (statics) is devoted to a discussion of experimental data.

The divisions on the Kinetics, Electro-chemistry and Photo-chemistry of Gas Reactions take up about 130 out of the total of 844 pages of the work.

Dr. Jellinek's book stands alone as the most up-to-date and complete repertory of a vast amount of information scattered through current literature, and not elsewhere presented in collected form.

A. J. L.

HARRINGTON EMERSON'S HOME COURSE OF STUDY IN PERSONAL EFFICIENCY. The Emerson Institute, 30 Irving Place, New York.

In twenty-four lessons Mr. Emerson has shown how any intelligent person can apply efficiency principles to his conduct at home and in business and increase his usefulness. The lessons are not mere talks on efficiency, but eminently practical and definite instructions. Time sheets, record cards, and all the paraphernalia of the efficiency engineer are placed at the reader's disposal, with complete explanations how they are to be used. There cannot be the slightest doubt that if the course is conscientiously pursued, it will enable anyone to increase his efficiency many times. Mr. Emerson's exceptional literary gifts have enabled him to make this course not only instructive but extremely interesting. There is nothing humdrum and dry in his presentation of a subject with which his name is intimately connected. Baseball, tennis, swimming, household duties, a thousand and one activities that enter into the lives of men and women at large, are drawn upon for happy illustrations of what efficiency and inefficiency mean.

JAHRBUCH DER LUFTFAHRZEUG-GESELLSCHAFT. Sechster Band. 1912-1913. Berlin: Verlag von Julius Springer, 1913.

Germany publishes probably more exhaustive technical information on aeronautics than any other country—information which takes the shape, not only of books and periodicals, but of annuals issued by technical and learned societies devoted especially to the furtherance of aeronautics. Of these annuals, one of the most important is the "Jahrbuch der Luftfahrzeug-Gesellschaft." The contributors are all of them men who stand in the foremost rank as authorities in their especial fields. Thus we find in the volume which lies before us a splendid contribution by Count Arco on wireless telegraphy in aeronautics, an exceedingly able mathematical analysis of the distribution of strains in the envelopes of non-rigid dirigibles by Karl Heyer, and a very instructive report on the Goettingen aerodynamic laboratory by the distinguished Prof. Prandtl himself. In a work such as this one obtains glimpses of the activity of German aeronauts of which one hears but little in the press. The volume which lies before us may be heartily recommended to those who take a technical interest in aeronautics.

MEERES FISCHE. Von Dr. Kurt Floericke. Kosmos Gesellschaft der Naturfreunde. Stuttgart: Franck'sche Verlagshandlung, 1914.

This is a popular, interestingly written book on some common and some unusual forms of fishes. It gives an insight not only into the life history of some interesting fishes, but also the industrial uses of fishes.

THE FOUNDATIONS OF NORMAL AND ABNORMAL PSYCHOLOGY. By Boris Sidis, A.M., Ph.D., M.D. Boston: Richard G. Badger. 8vo.; 416 pp.; illustrated. Price, $2.50 net.

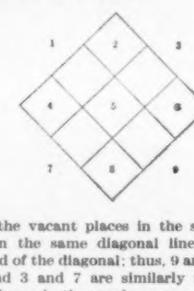
Some day, perhaps, H. G. Wells may write an article on the scientific postulate and posterity. Whatever else such an article might be, it would be eminently readable. As Prof. Sidis points out, even such an exact science as mathematics has had its axioms disputed. Psychology is one of our baby sciences, and no doubt its present working theories partake rather of the nature of scaffolding than of corner-stones. Yet this scaffolding is indispensable to the erection of a substantial structure. Hence Prof. Sidis very properly devotes much of his space to elucidating the formulated assumptions of psychology. He deplores the existing tendency to confound this study with spiritism, religion, and the faith cure. No one who follows his fascinating exposition can long harbor that delusion. In the latter portion of the work such subjects as stimulation, reaction, exhaustion, inhibition, unity, synthesis, and purpose, in all their ramifications and interrelations, are discussed in a masterly manner, and the author's own theory of "moment-consciousness" is exhaustively explained. This theory appraises the quality, and follows the development of, consciousness, from reflex, through complex reflex and instinctive, to its highest form—self-consciousness. In all this journey he is careful not to ignore the biological viewpoint, hence we have true progression instead of what is so apt to degenerate into futile loiterings and wanderings. The normal and the abnormal are made to throw light the one upon the other, a mode analogous to the trial-balance proof of the accountant, and one that results in an eminently sane and balanced concept. Prof. Sidis has worthily extended the observations of the late William James, to whom as master and friend the present volume is dedicated. He does not, however, fatuously accept all James's conclusions, but indorses his psychological introspection, while rejecting many of his metaphysical complications.

THE A B C AND X Y Z OF BEE CULTURE. A Cyclopedia of Everything Pertaining to the Care of the Honey-Bee; Bees, Hives, Honey, Implements, Honey-Plants, etc. By A. I. and E. R. Root. Medina, Ohio: The A. I. Root Company, 1913. 8vo.; 717 pp.; illustrated.

The Roots, father and son, have been so fortunately situated that they have been able to supplement their own wide experience with that of numberless others, and thus to keep fully abreast of the most recent practice and experience. So that the somewhat grandiloquent claim of their title and sub-title seems to be fairly well borne out by the book itself. In this the knowledge of thousands of beekeepers is embodied, and in most cases the theories presented have been verified in their own apiary. Every branch of the industry from production to sales is treated, and the arrangement follows the aphabetical order, so that any required information is instantly accessible.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13007) W. C. P. writes: The Magic Squares which appeared in the SCIENTIFIC AMERICAN a few years ago, came recently to my attention, and I recalled a graphical solution which I once saw for making the simpler forms of these curious arrangements of numbers, those employing the nine digits and also the first sixteen numbers. These I will give. Write the nine digits, and draw a square as shown, obliquely



Now fill the vacant places in the square by the number in the same diagonal line, but at the farther end of the diagonal; thus, 9 and 1 exchange places, and 3 and 7 are similarly moved. The result is shown in the magic square:

$$\begin{array}{ccc} 4 & 9 & 2 \\ 3 & 5 & 7 \\ 8 & 1 & 6 \end{array}$$

This may be easily generalized so that any nine consecutive numbers may be arranged in a magic square as follows: Let n be any number, and write the nine numbers in the same order as given with the figures. You will have the square:

$$\begin{array}{ccc} n+3 & n+8 & n+1 \\ n+2 & n+4 & n+6 \\ n+7 & n & n+5 \end{array}$$

With this square, any number of squares may be made. Let $n = 0$. The resulting square is given. The sum of the lines and diagonals is 12.

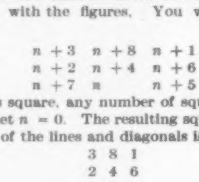
$$\begin{array}{ccc} 3 & 8 & 1 \\ 2 & 4 & 6 \\ 7 & 0 & 5 \end{array}$$

Let $n = 13$; the resulting square is

$$\begin{array}{ccc} 16 & 21 & 14 \\ 15 & 17 & 19 \\ 20 & 13 & 18 \end{array}$$

The sum is 51.

A graphical method may also be applied to squares of 16 numbers, as follows: Write the numbers and draw lines across the square as shown. Then



exchange places of the numbers at the ends of the lines. The result will be a magic square.

$$\begin{array}{cccc} 1 & 15 & 14 & 4 \\ 12 & 6 & 7 & 9 \\ 8 & 10 & 11 & 5 \\ 13 & 3 & 2 & 16 \end{array}$$

It is seen that the numbers at the corners and the four in the center remain in their places.

This arrangement can also be generalized, as follows:

$$\begin{array}{cccc} n & n+14 & n+13 & n+3 \\ n+11 & n+5 & n+6 & n+8 \\ n+7 & n+9 & n+10 & n+4 \\ n+12 & n+2 & n+1 & n+15 \end{array}$$

Using this square by giving n any value whatever, a magic square will be formed. Perhaps, and probably, the more elaborate squares may be drawn out graphically.

(13008) A. B. C. asks how he can see the spokes of the wheels of a passing motor-car standing still or even turning backward when the light was not rendered intermittent by the pickets of a fence or any other visible means. A. We have always answered this query by saying that the light must be intermittent in order to produce this phenomenon. A paper which appeared in the Proceedings of the Royal Society, which has recently come under our notice, considers this question and applies the test of experiment to it. The statement is made that these appearances are real, last but for a fraction of a second, and coincide with the steps of the observer. The rate of the forward motion of the eye produces the effect. It is only to be seen also when the speed of the vehicle lies between certain limits. The motion of the spokes must be too quick for the eye to follow and must not exceed a certain limit, which is not quite the same for all persons. The matter was tested experimentally by means of a disk of black paper on which white spokes were drawn. When as few as 9 or 10 spokes pass a point in a second, only a flicker results. When 80 or more pass in a second, only a gray surface can be seen. The individual lines are invisible. Between these limits it is possible to produce the effect of intermittent vision.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9372. Wanted the name and address of manufacturers of a collapsible box about 12 inches square. It must be strongly made to withstand rough usage in transit.

Inquiry No. 9373. Wanted the name and address of a manufacturer of machinery that will make twine out of scrap paper.

Inquiry No. 9374. Wanted the name and address of manufacturers of a powder paste which, when mixed with cold water, will make a white paste suitable for papering, costing no more than 3 cents per pound in ton lots.

Inquiry No. 9375. Wanted the name and address of the manufacturer of a separable fastener, invented especially for shoes and other articles.

Inquiry No. 9376. Wanted, the name and address of a manufacturer making clock-work mechanism for running window display machines as employed by safety razor manufacture.

Inquiry No. 9377. Wanted, the names and addresses of factories making farm implements for export.

Inquiry No. 9378. Wanted, the name and address of a manufacturer of smooth metal mirror frames, such as are sold in 5 and 10 cent stores, with a mirror and a cardboard back.

Inquiry No. 9379. Wanted, meteorites—information desired concerning available specimens.

Inquiry No. 9380. Wanted the name and address of a manufacturer of burners and handles for gas-heated sad iron.

Inquiry No. 9381. Wanted the name and address of manufacturers of vacuum adhesive hangers or other appliances for hanging cards, frames, charts, etc., to walls of buildings.

Inquiry No. 9382. Wanted the name and address of a manufacturer who can make a small or large quantity of sugar bowls with trade marks incorporated therein.

X-ray in Treatment of Disease

(*Concluded from page 4.*)

rays. To overcome the second difficulty, the source must be placed at a considerable distance from the subject to be treated, so that differences in the distance of the several parts subjected to the rays become insignificant in comparison with the actual distance.

The Method of Cross-firing.

With all the special measures discussed above, it would not be possible to produce an entirely homogeneous field of Roentgen radiation, extending to deep-lying structures and organs. Still less would it be possible to expose an internal organ to radiation of greater intensity than the overlying surface structures, as may be desirable for the treatment of internal tumors. True, in exceptional cases a specially constructed X-ray tube, or a part of such tube, may be introduced into the body. In some cases, also, the use of radium may be resorted to. But what is to be done in the case where neither of these methods is applicable?

The resources of the physicist are not yet exhausted. If two streams of rays are sent into the body through different entrance areas, that portion of the field where the two streams cross will be exposed to a double radiation, while the skin, for example, receives only a single stream. In this way a diseased part can be given an energetic dose, while for the healthy parts the dose may be kept below the limits at which undesirable effects become felt.

We have here discussed only the methods of application of X-rays. It is not our function to discuss their efficacy as a remedial agent. We must restrict our remarks on this point to the statement that as yet the invisible radiations cannot be looked upon as cures for cancer, although some promising results, especially with myoma and superficial growths, have been obtained by some of the workers in this field. In certain cases, too, where cure would hardly be looked for, at least considerable relief for the patient was secured. The whole field of radiotherapy is still in its infancy. While, for this reason, the value of the results obtained so far, and of those to be expected in the future, is somewhat a matter of dispute, all homage is due to the able and earnest workers who are straining every effort to advance this branch of medical science. In Germany, in particular, very excellent work in the X-ray treatment of tumors has been done by Prof. Bumm of Berlin, and Profs. Krönig and Gauss of Freiburg. Promising results have also been reported by Profs. De la Camp and Küpferle in the treatment of pulmonary phthisis.

We cannot close without a word of warning to prevent any possible misunderstanding. So long as radiotherapy is in its present experimental stage, it must be remembered that in many cases the only safe course is to resort to the knife. A competent surgeon's advice must in all cases be followed, regardless of any sacrifice which it may involve. Hesitation, in such matters, may be paid for at a terrible cost.

The Manufacture and Fitting of Piston Rings

(*Concluded from page 11.*)

around so that the joints formed a continuous opening, and as the notch cut out of the joint to accommodate the pin would materially weaken a small ring, some designers employ no pins whatsoever.

Inasmuch as the rings must be compressed, in order that the piston may be inserted in the cylinder, the depth of the ring groove must be equal to the thickness of the ring. As the rings expand to conform to the size of the cylinder bore, a small space is left between their inside circumference and the back of the grooves. Therefore, if the edges of the rings did not fit closely against the sides of the grooves, a space for the escape of the gas would be allowed back of each ring, and consequently the finish and fit of the sides of the ring and groove is another important matter to which much attention is paid by reliable manufacturers.

There is, naturally, but one position of each ring in which it can form an absolutely perfect circle, and the ring is so designed and cut that these conditions obtain when it is expanded to fit the cylinder walls. Theoretically, a ring should press with equal force against all parts of the cylinder wall, and these conditions can most nearly be obtained if the ring is cut eccentric, with the ends, at the joint, thinner than the center. The usual practice is to make the ends one half of the thickness of the center. However, inasmuch as the ideal condition of equal pressure at all points is impossible to attain, many manufacturers contend that the concentrically formed ring serves the purpose as well, and is stronger at all points than is that of the eccentric shape.

Piston rings are generally cut from long, cast iron cylinders, approximating in both outside and inside diameter the size to which the ring is to be formed. This cylinder is sometimes known as a "pot," and is cut in a special fixture placed in a lathe. The pot is generally of sufficient length to enable twelve or fifteen rings to be cut from it by means of a special tool designed for the purpose. This tool consists of a series of parallel, stationary cutters that are mounted on the tool carriage and fed toward the axis of the pot. There are, of course, as many tools in the series as there are rings to be cut from the pot. Each successive tool of the series is generally arranged at a greater distance from the pot to be worked, so that all do not start cutting at the same time. The edge of each tool is sometimes rounded slightly so that a thin circle of material remains at the inside edge of each ring. This is removed when the rings are ground.

If the rings are to be cut eccentrically, the pot is mounted on a fixture having a pivoted stud. The pivot is at a certain distance from the center of the fixture and stud, and the swinging limit of the latter is regulated by a slot and pin. The stud and pot are moved to the outer extremity of the slot when the outside finishing cut of the cylinder is to be taken, and then swung back to the inside limit when the interior is to be bored. This serves to throw the pot "off center" by a sufficient amount to make the inside diameter eccentric in relation to the outer diameter. If the pot is eccentric, the rings from which it is cut will also, naturally, be eccentric. After being turned and bored, the pots are put away, to season and cool. This relieves the material of the strains that will always be induced in cast iron by any machining operation.

The necessity for making rings of exactly the proper width has resulted in the design of several special types of grinding machines. The grinding and polishing wheel machines to closer accuracy than any other tool, and therefore the half-thousandths inch exactness necessary is entrusted to this. An interesting type of edge grinder consists of a rapidly revolving emery wheel, set on a horizontal axis, and a slower-turning bed, or chuck, placed under the periphery of the wheel, and at right angles to its surface. The ring to be ground is placed on this chuck, and as the periphery of the rapidly revolving emery wheel impinges on the edge of the ring, the latter is ground to the correct size—provided the chuck has been set in the proper position. In order to facilitate the setting of the ring in the chuck and its removal therefrom, the chuck differs from that of the jaw type ordinarily found on a lathe. The ring is held in place by means of the magnetism of an electrically excited core forming the bed of the chuck, and controlled by a switch placed near the operator. When the ring is placed on the bed of the chuck and the current turned on, the work is held rigidly in position. A machine of this type can easily grind 500 rings per day, and at the same time do the work so accurately that but few fail to pass the rigid tests conducted by the inspectors.

The finishing of the outside faces of the rings is done in a more common type of grinding machine. This is similar, in general appearance, to a lathe with the work placed in the ordinary position on an arbor carried between the headstock and

tailstock. A high-speed emery wheel is driven on a parallel shaft, and the feeds are so arranged that the distances between the two shafts may be changed, or the wheel itself may be moved longitudinally along its axis. The rings to be finished are mounted on a cylinder or mandrel, provided with an adjustable clamp at one end, and when a dozen or so are pressed tightly along each side of each other and the clamp is set, the rings are held rigidly in place. All rings are thus ground to the same diameter, and if they have previously been split, they should be tightly closed when mounted, in order that their outside will be finished to a perfect circle.

The finishing of the inside of the rings is a matter of varying practice. Some manufacturers believe that the small scale left after casting and boring renders the ring more elastic, and therefore do not attempt to remove it. All well-made rings are thoroughly tested by expert inspectors, however, and the width and thickness measured to the half-thousandth of an inch. The ring is further tested for flaws in the metal, and is then examined to determine its elasticity by expanding it sufficiently to slide over a piston of the same size as that for which the ring is intended. If it is discovered that any permanent set has taken place after this operation, the ring is discarded as being insufficiently flexible. Rings are also discarded if, after compression to a perfect circle, they fail to spring back to their normal size.

As a chain can be no stronger than its weakest link, so can the ordinary piston ring be no tighter than its joint. This weakness of the joint of the piston ring has led to the design of several types in which the joint is "backed up" or reinforced by another ring or pair of rings. One of the best known of this class of rings consists of two separate rings of "L" section, of such a size and shape that the projection of the "foot" of one "L" equals the thickness of the "shank" of the other, and the section of the two as they are fitted together becomes a perfect rectangle. Each ring, of course, is split to allow for the proper expansion, and a pin holds each in its correct position with relation to the other, so that the joints must remain opposite each other.

In other types of this "jointless" ring, an outside ring of full width is used, while surrounding this are two rings of half width. Various shapes are employed to hold the three pieces together; one of the simplest of these is to frm the two narrow rings of "L" section with the "feet" adjoining in the center and making a "lip" that exactly fits in the groove provided in the larger inner ring. In other forms, the larger ring is the outside one, while the two rings of half width are placed inside. In all cases, the individual rings are pinned to their neighbors, to prevent any of the openings from falling into line.

It will be noted that rings of this type do not need to be pinned in the piston, as their jointless form eliminates any possibility that the compression of the force of the explosion will "blow through" because of the change in the position of the individual rings.

Neglect of the Human Machine

By Eugene Lyman Fisk, M.D., Director of Hygiene the Life Extension Institute, Inc.

TO speak of the human body as a machine may offend some people's sensibilities, but we must take that risk, conceding, of course, that the analogy should not be carried so far as to include man as a whole, because, notwithstanding all that has been written, from Thales to Bergson, nobody knows what man *is* as a whole.

Many machines are "fool-proof," but it is not so with the human body.

True, there is a certain "factor of safety" that allows for ill treatment of the body, for starvation, for gluttony, for poisoning, for infection, and for various other strains and stresses, just as every well-built machine is planned to withstand more wear and tear than it is called upon to undergo with average use; but this factor of safety is not the same in all individuals. In some, it is a negligible quantity, in others, it is raised to the "nth" power, as in the occasional in-

stance of an old toper who lives into the eighties well nigh poison-proof, like Mithridates of old.

That most people exceed their factor of safety is shown by the fact that few people die a physiological death, if one may use such a term. The human clock usually *breaks down* instead of "*running down*." For example, in the United States there were, in 1910, more than 100,000 deaths, between the ages of forty and sixty, from diseases of the heart, circulation and kidneys. Preceding most deaths (not due to accident or to acute disease) there is usually a long period of impairment, or of progressive changes that gradually reduce the value of the individual to himself and to society before the final and total loss.

Is this condition of affairs creditable to human intelligence?

Should we be content with the mere survival of the race? Is it any more reasonable to be satisfied with the average man as he is to-day than it would have been to rest satisfied with the locomotive of the forties?

That man as a practical, every-day, useful citizen, cannot exist by will power or by psychic force alone, but is dependent upon the mechanical integrity of his parts, is shown by a very brief survey of elementary physiological facts.

Consider the circulatory system alone. The heart is a pump that forces the blood through a system of elastic tubing—the arteries. If this tubing is overstrained, it deteriorates and frequently it bursts, causing death by apoplexy, if the affected tube happens to be in the brain.

Now, let us suppose that in every household there was a complex machine operated by a pump, and a system of delicate tubing upon which the life of the family depended. Let us assume that the bursting of that tubing or the breaking down of the valves or of the walls of the pump would bring death into the household—what would be the public and private attitude toward such a machine? Undoubtedly the government would inspect it regularly even if individuals could be found so foolhardy as to neglect such an obvious duty, in line with the so-called first law of nature—self-preservation.

There may be something repellent in the mechanistic truth that the mighty brain of a philosopher or of a statesman is just as dependent upon the potency and integrity of certain elastic tubes as is that of the hound that lies at his feet, but such is the fact, and if the philosopher or statesman wishes to be spared for a reasonable time to carry on his work, he must take care of his tubing.

Of what avail is inspection of the human machine? Can inspection detect changes in the working parts in time for the repair man to make things right? Fortunately the answer is emphatically "YES." Long before the tubing, which we have referred to as so important a part of the human machine, is seriously impaired, the fact of over-strain can be determined and the strain being abated, the life of the tube is prolonged; also the keen inspector can detect the early signs of failure in the pump and said pump can be strengthened and its burdens adjusted to its capacity.

Long before the kidneys—those sponges for absorbing and separating from the blood-current its waste products—are seriously impaired, the microscope and the chemical re-agent can reveal the signs of over-strain. Heart, blood vessels, and kidneys are closely dependent each upon the other and the inspector's tests seldom fail to find a weak spot in this system, if it be present.

Many of these human machines can be adjusted to run perhaps for many years at a lower speed, whereas, a continuance of high speed would mean early and inevitable breakdown. In other cases, the machine is doing the wrong kind of work or it is not being operated with the right kind of fuel.

Are these mere scientific day dreams as illusive as the philosopher's stone or the elixir of life? Fortunately for the ready acceptance of these truths, they have been tested in the practical business world as a matter of business economy.

About five years ago, the officers of a life insurance company decided to offer to their policyholders the privilege of a free medical examination once each year for the purpose outlined in this article, namely, inspection of the human machine in order to detect the need for repair. Out of 2,500 people who accepted this service, 40 per cent were found more or less out of order and in need of repairs, most of the derangements being found in the heart, blood vessels and kidneys, as the average age of the group was high, 46. Of those found impaired, 44 per cent *were not aware* of impairment. The insurance company did not, of course, undertake to treat these people, but with their consent reported the impairment to the family physician or to such physician as the policyholder designated, upon whom the task of repairing the machine devolved. What was the result? At the end of four years, an actuarial analysis showed that among those found impaired the death rate had been only 97 per cent of that upon which premiums are based, or since they were impaired risks, or about 50 per cent of that reasonably to be expected, allowing for the impairments. In other words, if these risks had not come under the system of periodic health examinations the mortality would have been double that actually experienced. Making all possible allowance for the smallness of the group and the short duration of the experience, an emphatic saving of life was demonstrated. Even among those reported unimpaired, a very low mortality was experienced, as many of these people were on the border line of impairment or were not living hygienically and were guided accordingly.

This system has since been made available to all insurance companies and to the general public as well by the recent establishment of the Life Extension Institute, Inc., through the efforts of Mr. Harold A. Ley, a prominent business man of Springfield, Mass., and Prof. Irving Fisher, of Yale. These gentlemen have enlisted the aid of ex-President Taft as Chairman of the Board of Directors, Mr. E. E. Rittenhouse as President, Surgeon-General Gorgas, and nearly one hundred of the leading scientists and publicists in this country and abroad as a Hygiene Reference Board to assist in guiding the scientific and educational policy.

Regular inspection of the human machine, therefore, will soon include a large proportion of the population and no doubt become in time a commonplace and commonsense measure, just as obviously necessary to individual and social welfare as the inspection of banks and insurance companies, and of the various machines that are likely to go wrong and kill.

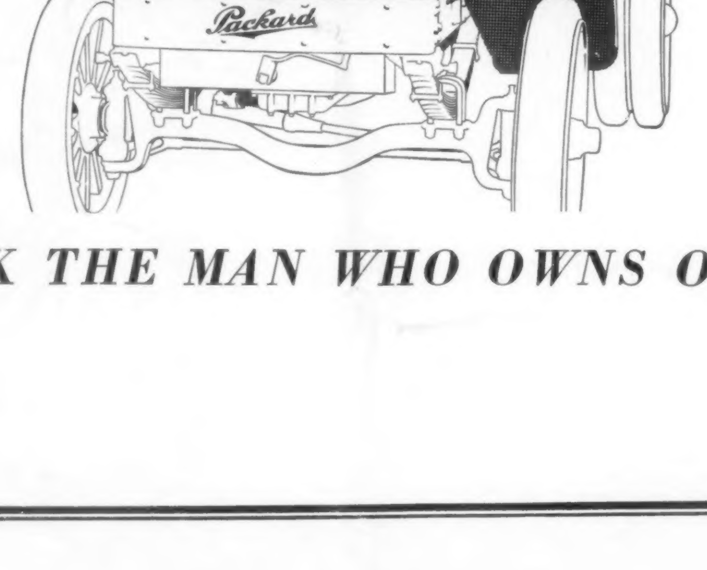
If the human machine is found to be out of repair, what next?

When an ordinary machine is out of repair, we use common sense in selecting a repairer. If it is an electrically-driven machine, we send for an electrician; if it is the plumbing, we send for the plumber; but when the human machine is out of order, we ask our neighbor or the druggist or even the office boy for advice until pain finally drives us to the human repairer—the physician—who is expected to undo all the harm that our procrastination has wrought.

Surely, a patient enjoys more keenly being kept alive and well than having a learned diagnosis made, out of which he can extract no satisfaction except the morbid consciousness that he is an "interesting" and utterly hopeless "case."

It is better not to become a "case." It is well to have our "works" regularly inspected, so that the repair man can be called in time if he is needed.

South American Trade-mark Laws.—Under the law governing trade-marks in Argentine anyone may register a trade-mark, if such mark has not been registered by another, thus enabling unscrupulous persons to anticipate the entrance into the market of a foreign trader or manufacturer and force him to pay the registrant for the use of his own trade-mark. This has been remedied in part by a decision of the Federal Appeal Court which provides that a person who has registered a trade-mark will not be permitted to institute criminal proceedings for infringement of such mark unless he either manufactures or deals in the goods distinguished by the trade-mark in dispute.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